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ABSTRACT

A research study identified the work force education and training requirements for communication and information technologies that form the key elements of a human resources development plan at the U.S. Army Aviation Center (USAAVNC), Fort Rucker, Alabama, for the 1990s. Qualitative data were collected from key personnel interviews, discussions by a group of experts, and survey questions. Quantitative data were collected from a survey sample of 198 workers in the Directorate of Training and Doctrine, USAAVNC. Analysis of results using developmental scientific methodology produced four categories concerning communication and information technologies: (1) mission, policies, and plans; (2) applications; (3) worker critical skills; and (4) work force education and training requirements. Results indicated that the mission of USAAVNC must be more clearly understood. Policies must be created for systematic and planned implementation of state-of-the-art communication and information technologies and for development of organization and human resources. A crucial application was an integrated work station. Workers needed cognitive and basic computer skills. Work force education and training requirements were grouped into strategy, scope, standards, and primary critical tasks. Appendixes contain the following: outlines of the U.S. Army Training and Doctrine Command and the USAAVNC mission and organization; instruments; and key elements of the USAAVNC human development resources plan. (Contains 144 references.) (YLB)

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WORKFORCE EDUCATION AND TRAINING REQUIREMENTS FOR COMMUNICATION AND INFORMATION TECHNOLOGIES AT THE UNITED STATES ARMY AVIATION CENTER

by

Michael Wayne Cupples
Dr. Warren H. Groff, Advisor

U.S. DEPARTMENT OF EDUCATION
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A Major Applied Research Project (MARP) of this effort and scope has been a meaningful learning process. More people than I will be able to name have made significant contributions to this MARP. Without their influence, advice, and help, this MARP would not have been possible. I express my sincere appreciation to all those people who made a contribution.

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Abstract of a Major Applied Research Project Presented
to Nova University in Partial Fulfillment of the
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Effective institutions have a clear mission and a plan or set of plans to achieve that mission. The mission of the United States Army Aviation Center (USAAVNC), Fort Rucker, Alabama, is to provide career education and technical training of high quality to aviation personnel who are critical in keeping the peace or in waging a successful integrated air and ground war. To accomplish that mission, the Army is making increased use of state-of-the-art communication and information technologies for administrative purposes and for the development, delivery, and support of classroom instruction and flight training.

The purpose of this Major Applied Research Project (MARP) was to identify the workforce education and training requirements for communication and information technologies that form the key elements of a USAAVNC human resources development plan. Working on the MARP involved a practical understanding of the USAAVNC mission and a conceptual comprehension of

total quality management, workers' skills, applications, and workforce education and training for technologies in today's advanced technical society.

There were four major research questions: (1) what are the communication and information technologies that will be used for administrative purposes and for the development of instruction over the next several years? (2) what are the worker critical skills that will be necessary to use the next wave of these technologies? (3) what will be the educational and training requirements of the workforce? and (4) what are the key elements of a USAAVNC human resources development plan? These questions were answered with both qualitative and quantitative data.

Qualitative data were collected from key personnel interviews, discussions by a group of experts, and survey questions. The quantitative data were collected from a survey sample of 198 workers in the Directorate of Training and Doctrine (DOTD), USAAVNC. Analysis of results using developmental scientific methodology produced four categories for organizing interpretations, conclusions, and recommendations concerning communication and information technologies: (1) mission, policies, and plans; (2) applications; (3) worker critical skills; and (4) workforce education and training requirements.

The MARP results revealed that the mission of USAAVNC must be more clearly understood and must be the conceptual framework for development of policy and the creation and continuous refinement of plans for the development of organization and human resources. Policies must be created for systematic and planned implementation of state-of-the-art communication and information technologies and for the development of organization and human resources.

The applications of communication and information technologies that are crucial contributions to the successful accomplishment of the USAAVNC mission are the micro-computer, software features, a high quality printer, a digital color copier, a facsimile (Fax), data base(s), a modern phone system, and interactive network(s) of distributed systems. Workers need the critical skills of willingness/ability to learn; understanding information; recognizing concepts; synthesizing implications; organizing efforts; solving problems; basic computer skills; and knowledge of systems, software, and procedures.

The workforce education and training requirements for communication and information technologies can be grouped into four essential areas of consideration: (1) strategy, (2) scope, (3) standards, and (4) primary critical tasks. These areas represent the basis for the key elements of a human resources development plan. Education and training should be (1) conducted as soon as a worker is assigned, (2) synchronized to be timely with arrival of technologies, (3) standardized to facilitate learning and meet job requirements, and (4) linked to personnel and funding management documents.

The MARP has been made available to the Army research community to support more educational research and statistical studies to build the analytical underpinnings of a solid foundation for the planning of workforce education and training in the Army school system. Senior leaders and key personnel must recognize that, ultimately, the security of the United States is based upon competent human resources that use state-of-the-art technologies. Only when humans and technologies are properly combined is the United States in a position of global leadership and influence to preserve the peace.

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Chapter 1

INTRODUCTION

Education, industry, and the military are in the new era of ever increasing applications of communication and information technologies and are, therefore, rapidly modernizing and automating their institutions. Applications of these technologies create challenges in the development of organization and human resources.

To increase productivity and improve quality of work, an urgent need exists for a human resources development plan to be developed based on the workforce education and training requirements for the new advanced technologies. A major challenge is the identification of workforce education and training requirements for communication and information technologies. Education and training of the workforce are critical to the successful adoption, use, and integration of these technologies during Department of the Army modernization efforts.

Both the Army leadership and workforce must become more aware of the power of communication and information technologies and the potential enhancements to organizational processes, workplace productivity, and quality of work. The United States Army Training and Doctrine Command (USATRADOC), Fort Monroe, Virginia, administers the Army school system for career education and technical training of over one million Active Army and one million Army Reserve/National Guard personnel. The Army school system is

being modernized with communication and information technologies in a manner similar to that of competitive establishments in the civilian community. The modernization of the workplace through these technologies is critical to the national interests and security of the United States.

USATRADOC carries out its education and training mission through eight initial entry training centers, twenty-seven service schools, sixteen institutions, three combined arms integrating centers, and two Army Colleges. (USATRADOC mission and organization are discussed in Appendices A and B, respectively.) USATRADOC mission is achieved with a workforce of over 90,000 military personnel and Army civil service employees with an operating budget of $2.4 billion in 1991.

The United States Army Aviation Center (USAAVNC), Fort Rucker, Alabama, is the sole provider of career education and technical training for aviation personnel. (The USAAVNC mission and organization are discussed in Appendices C and D, respectively.) USAAVNC annually trains over 2900 aviation personnel through contemporary communication and information technologies used by approximately 8500 military personnel and Army civil service employees with an operating budget of over $969 million in 1991. Competent Army aviation personnel are critical in keeping the peace or in waging a successful integrated air and ground war.

The applications of state-of-the-art communication and information technologies are particularly important at USAAVNC because of its mission of career education and technical training of aviation personnel. These technologies are used for administrative purposes and the development,

delivery, and support of classroom instruction and flight training. The identification of the workforce education and training requirements is crucial for the development of the key elements of a human resources development plan for the 1990's and for the successful adoption, use, and integration of these technologies during modernization efforts at USAAVNC.

The purpose of this Major Applied Research Project (MARP) was to identify the workforce education and training requirements for communication and information technologies at USAAVNC. Key elements of a human resources development plan for these technologies must be developed.

MARP expectations, using developmental scientific methodology, were to (1) create a basis for near-term managerial interventions, a strategic plan, and a unified vision within the workplace; (2) raise senior leaders' interest in addressing workforce educational considerations for technologies; and (3) establish key elements for a USAAVNC human resources development plan. In addition, the expectation was that the Army, USATRADOC, and USAAVNC senior leaders will continue to support more educational research and statistical studies. These investigations should build the analytical underpinnings of a solid foundation for optimal planning of workforce education and training for technologies in the Army school system.

Statement of Problem

USAAVNC is modernizing through communication and information technologies. Implementation of communication and information technologies has been more ad hoc and random than systematic and planned. The early

wave of these technologies was free-standing and less complicated than the more recent wave of technologies. In the past, many workers were able to develop the required skills that were necessary to use the early wave of technologies to enhance utilization of technologies, organizational processes, productivity, and quality of work.

Emerging communication and information technologies, such as artificial intelligence, expert systems, high resolution video, interactive software, telecommunications, notebook computers, speech processing, microwave technology, and others, however, are more complex and have tremendous implications for the development of organization and human resources. USAAVNC does not have a comprehensive plan or set of plans that integrate the applications of technologies in terms of worker critical skills and workforce education and training requirements for these technologies. The MARP addressed this critical issue by bringing together essential information about applications, worker critical skills, and workforce education and training requirements for communication and information technologies.

USAAVNC, USATRADOC, and other similar Army organizations must develop a strategy to transform workplaces to the new era of increasingly complex advanced technologies. Senior leaders must understand fully the workforce education and training requirements for these technologies. They must collaborate on effective policies, plans, and programs for the development of organization and human resources to maximize organizational efficiency and reduce the risk of disillusionment and technology rejection by workers.

The emergence of the Pacific Rim countries, the economic integration of Europe during 1992, and the changes caused by the political upheaval in eastern Europe are significant global events that are influencing the future Army structure and mission (USATRADOC Long Range Plan, 1989:8). An informal review of preliminary USAAVNC staff studies reveals that USAAVNC is undergoing significant organizational changes due to this dynamic environment of fast-paced global changes, workplace modernization, Army workforce downsizing, resources reductions, and the adoption of total quality management.

Army senior leaders in the Department of the Army Staff, USATRADOC, and USAAVNC recognize the economic and practical significance of a more relevant and adequate human resources development program, increased productivity, and improved quality of work through modernization. During several USAAVNC command and staff meetings, most of the USAAVNC directors of the eight directorates and five departments have expressed concern that full implementation and use of communication and information technologies may not be occurring. Their concerns include a lack of knowledge and tolerance in: (1) these technologies that will be used for administrative purposes and the development of instruction over the next several years, (2) the worker critical skills that will be necessary to use these technologies, and (3) the education and training requirements that will be required for the workforce.

The lack of strategic planning, preferred scenario development, timely adaptability, workforce preparation, and enthusiastic innovation represent substantial challenges to successful implementation and use of communication and information technologies. Critical resources are being committed to the

modernization of the workplace to enhance utilization of technologies, organizational processes, productivity, and quality of work. The Army is placing increased emphasis on having its institutions more productive and relying on communication and information technologies to justify the expectations of increasing productivity, reducing cost of operations, streamlining management, reducing human resources, and downsizing organizations.

Background

Telegraph, postal service, telephones, typewriters, and other types of low and medium technology produced the conditions that allowed organizations to respond to the industrial era. In a similar manner, contemporary communication and information technologies in the advanced technical era are causing the evolution of the workplace which is based on electronics, communication, and information (Davis, 1991:59-65). Beer and Walton (1990) propose that these technologies have significantly transformed the organizational environment and the way that work is being done. Morgan (1988) stresses that implementation of technologies has forced a serious look at the basic principles of both organizational development (OD) and human resources development (HRD).

Toffler (1970, 1980, 1983, 1985, and 1990), Naisbitt (1984 and 1990), Masuda (1987 and 1990), Cetron (1982, 1985, 1986, 1988, 1989a, 1989b, 1990a, and 1990b), Zuboff (1982, 1985, 1988, and 1991), Gardner (1981, 1984, 1986, and 1990), and other writers suggest that today's challenge in career education and technical training is to prepare a diversified workforce to

change with the evolution of contemporary technologies. Workplace changes are both technological and behavioral in nature (Lin and Ashcraft, 1990:14). Workers are experiencing changes greater than those that occurred in either the agricultural or the industrial era (Gayle, 1990:10-12). Individual behavior change requires two conditions to be met: learning has to occur, and motivation to apply the learning has to exist (Stewart, 1989:31-35).

Drucker (1982, 1985, 1988a, 1988b, 1989a, 1989b, 1991, and 1992), Cleveland (1985a, 1985b, and 1986), Zemke (1984, 1985, 1987, and 1988), and other writers have noted in the literature during recent years that today's workforce often feels frustrated in the organizations designed for the productivity needs of the industrial era. Societal factors such as age, gender, ethnicity, socio-economic status, and previous experience of workers with technology may have a relationship to their attitudes concerning the applications of technologies (Marien, 1992:340-344).

Failure of the workforce to learn the critical skills that are necessary to use communication and information technologies could lead to a powerless worker unable to cope with the forces of change in the advanced technical workplace (Cyert and Mowery, 1989:56-57). A synthesis of human behavior concerning adoption and use of technologies must be considered to reduce the possibility of workforce rejection of technologies (Miller, 1991:25). Carnevale, Gainer, and Meltzer (1990) emphasize that the basic skills of workers must be expanded for knowledge and information work--learning how to learn, intellectual skills, creativity, reasoning, synthesizing, adaptability, teamwork, developmental activities, communicating, and information processing.

Senior leaders must give more attention to the demographics of the Army workforce as both a cause for better education and training for technologies and as a factor that may significantly influence the adoption, implementation, and use of technologies (Hodgkinson, 1988:168). Today's workforce is aging and becoming more diversified--changing educational levels, values, attitudes, expectations, and loyalties (Workforce 2000, 1987). Human resources development affects workers' adoption of technologies during workplace modernization in relation to factors such as age, gender, functional literacy, previous education, socio-economic status, years away from education, and ethnicity (Molnar, 1990:60).

Workforce education and training are urgent human resources development issues for communication and information technologies to enhance organizational processes (Prentice, 1990:58-62). They are also significant parts of total quality management and strategic planning during modernization and office automation efforts (O'Neill, 1990:90). As a major advocacy effort, the strategic planning process can then be used as a tool for creating broader and more effective understandings for adult education and training (Page, 1990:11).

The literature supports the need to identify the workforce education and training requirements for communication and information technologies. However, little educational research and few studies have been undertaken to identify the education and training requirements of the workforce in relation to applications of these technologies and the worker critical skills that will be necessary to use technologies. Previous research has addressed primarily the potential relationship of the applications of contemporary technologies in a

modernized workplace to such issues as adult learning and development, value of education and training, fear of technologies, and demographics.

Significance to Education and Training

Modernization of the workplace through communication and information technologies at sixteen USATRADOC institutions is critical to United States national interests and security. Army leaders have not been able to realize the full value of implementation and use of these state-of-the-art technologies during modernization for many fiscal, technological, organizational, and behavioral reasons.

The introduction of communication and information technologies to the USAAVNC workforce has resulted in mixed feelings of anxiety, job insecurity, and uncertainty over career progression as reported by key personnel during many USAAVNC command and staff meetings. Many USAAVNC workers have little or no experience with these technologies at work.

Military personnel and Army civil service employees appear to be concerned about the implications of change, usefulness of communication and information technologies, stress related to the applications of these technologies, education and training requirements in the advanced technical workplace, performance appraisal criteria, and influence on career progression. Nevertheless, the responsible individuals within the Army, USATRADOC, and USAAVNC have not examined workforce education and training requirements in relation to applications of communication and information technologies and worker critical skills that will be necessary to use these technologies.

The identification of workforce education and training requirements for communication and information technologies should provide a catalyst for the development of organization and empowerment of the workforce. Leaders must understand workforce education and training requirements to enhance utilization of technologies, organizational processes, productivity, and quality of work. Empowerment will provide workers hope, opportunities, and a means to influence their career progressions, socio-economic expectations, and lifelong goals beyond what exists now.

Definition of Terms

Terms that require definition or have special meaning under the context of this MARP are defined on the following page:

Administrative purposes are workplace activities that include tasks such as typing/keyboarding, creation/transfer of documents, storage/retrieval of information, electronic filing, data manipulation, word processing, spreadsheets, networking of systems, and planning that support USAAVNC administration and operations.

Army workforce involves military personnel and Army civil service employees that consist of three basic categories of personnel--administrative, supervisory, and project action--who must work with communication and information technologies using organizational processes for the mission.

Communication and information technologies is the collective term for desktop computers, copiers, phone systems, printers, software, data bases, modem, networking of systems, videoconferencing networks, facsimiles (Fax), and other office automation in the modernized workplace.

Development of aviation instruction involves workplace activities that include tasks such as requirements definition; storage/retrieval of information; planning; typing/keyboarding; creation/transfer of documents, files, graphics, and spreadsheets; data manipulation; and networking of systems that support the development of classroom instruction and flight training for the career education and technical training of aviation personnel.

Empowerment is the change in individual's behavior through a process of enhancing feelings of self-efficacy that gives an individual a sense of power, control, or authority over significant aspects of life or work beyond what already existed before the change occurred (Senge, 1991).

Human resources development is based on learning theory and is focused on worker competencies and methods for disseminating the learning throughout the organization.

Modernization is the introduction of technologies in an organization to accomplish institutional mission for enhanced productivity and quality of work.

Office automation involves modernization concepts and electronic office systems for direct use by workers and their supervisors in the advanced technical workplace as tools in management of information processing tasks.

Organization development involves learning but is more concerned with long-range planned changes in technologies, management, and culture which impact the organization.

Strategic planning is process planning that is based on an audit of strengths and weaknesses and a synthesis of opportunities and threats to capitalize on opportunities and minimize threats (Groff, 1988).

Major Research Questions

The major research questions were as follows: (1) what are the communication and information technologies that will be used for administrative purposes and for the development of instruction over the next several years? (2) what are the worker critical skills that will be necessary to use the next wave of these technologies? (3) what will be the educational and training requirements of the workforce? and (4) what will be the key elements of a USAAVNC human resources development plan for the 1990's?

Chapter 2

REVIEW OF THE LITERATURE

A review of literature supports the need to identify the workforce education and training requirements for communication and information technologies. The identification of requirements should provide the basis for the development of organization and human resources at USAAVNC.

The review of related literature involves four main areas concerning communication and information technologies. These areas include adult learning and development, applications of these technologies, worker critical skills, and workforce education and training requirements.

Adult Learning and Development

The first area of the literature review concerns adult learning and development. Understanding the adult learner is important in being able to identify the workforce education and training requirements for communication and information technologies. Many studies especially emphasize a careful analysis of individual differences with respect to adult learning attributes.

Andragogy, or the science of assisting adults in the learning process, is the best known theory of adult learning; it is based upon four characteristics of adult learners--self concept, experience, developmental readiness, and time perspective (Knowles, 1984). Andragogic learning strategies for adults are (1) problem-centered rather than content-centered; (2) geared to active

participation; (3) oriented to encourage application of previous experience to new problems; (4) characterized as collaborative versus authority oriented; (5) mutually planned, evaluated, and redesigned by learner and instructor; and (6) experimental and immediately applicable (Danne, 1991:43-44).

Knox (1977) describes life-stage events in adults that create a heightened awareness or "teachable moments" where an adult realizes a need to acquire knowledge, skill(s), or attitude(s). Bandura (1986) stresses self-efficacy through a positive reinforcing cycle of change in behavior and attitude through motivation theory and behavior modification.

Strategies concerning worker learning and development for technologies can include a cognitive approach to explain, a behavioristic approach to practice, and a humanistic approach to help the worker to realize the value of working with technologies (Kramlinger and Huberty, 1990:44). Certain learner characteristics appear to be necessary in order to use communication and information technologies: ability to concentrate, persistence, an affinity for details and accuracy, and a willingness to work alone (Lewis, 1988:7).

In describing studies of the adult learner, Gagne' (1990) states that once new knowledge or a skill is acquired, its assimilation requires transition time and focused effort by the individual in practical application to real life situations. Training transfer is aided by applications of what is learned to specific work-place tasks in a timely manner. Comprehensive action plans, accountability strategies, and follow-up further increase the success of training transfer.

Carroll (1990), in his analysis of various studies on adult learning for computer skills, proposes to allow individuals to proceed through instruction at

their own rate in sequential order. Also, Bloom (1987) suggests that individuals do not learn at the same rate and that they should have control over pace of instruction as a means of helping them to master the learning objectives.

Applications of Communication and Information Technologies

The second area of the literature review covers the implications of the applications of communication and information technologies. Today, workers and supervisors live, work, and manage in an era of "megatrends 2000," an age of "transformational change," a challenge of "educational renaissance," and a "powershift" society about which Naisbitt (1990), Masuda (1990), Cetron (1989b), and Toffler (1990) have written.

Hackett (1990) states that industries have invested over $180 billion in applications of technologies to increase productivity and reduce operating costs. Studies in Multiple Input Productivity Indexes (1988) by the American Quality and Productivity Center show little benefit of this investment in systems, software, and procedures for the improvement of the effectiveness of the workforce in the service sector--finance, insurance, wholesale, retail, and business service. The Harvard Business Review Leadership survey reveals that without an analysis of organizational processes and workforce requirements for technologies, many applications of these technologies fail because the designers of technology are naive about the mission, the structure, and the processes of organizations and often ignore the additional burden placed on workers to acquire new knowledge and to learn technical skills (Jaikumar, 1991:100-101).

Involvement and understanding by management appear to be the key to successful implementation of technologies (Schleich, Corney, and Boe, 1990:9).

Bagozzi, Davis, and Warshaw (1989) emphasize that the need exists for better determinants of workforce acceptance and the use of communication and information technologies to focus practical value on these technologies and to guide managerial interventions aimed at reducing the problems of underutilized technologies and unskilled workforce. Researchers find little correlation between costs of communication and information technologies and productivity in the advanced technical workplace. The frail relationship of these variables has often weakened the argument for modernization of the workplace with advanced technologies (Bailey, 1991:11-20). Olivas and Inman's (1983) survey of corporate training department personnel reveals that the foremost questions concerning them were "Will it increase productivity?" and "Is it worth it?"

The introduction of technologies is accelerating far-reaching changes in the nature of work, thus creating the advanced technical workplace and challenging the development of organization and human resources (Drucker, 1992:93-117). A survey of senior executives from both public and private sector reveals that the introduction of new technology is the most frequently cited reason for significant change within an organization (Herzog, 1991:7).

Hirshhorn and Gilmore (1992) propose that advances in communication and information technologies seem to trigger the recognition and implementation of new, not previously possible, organizational design options. The applications of these technologies empower organizations to (1) change the way they do business, (2) streamline organizational structure, (3) extend the

scope of vision, and (4) use human resources more effectively (Bleecker, 1991: 18-20). An organizational structure called the learning community, which involves the empowerment of workers to contribute more to the mission, is emerging in place of the old bureaucratic model (Kiechel, 1990:133-134).

Since the introduction of the first useful computer almost half a century ago, distribution of communication and information technologies has occurred dramatically because of the lower cost-performance ratios and the scope of integrated networks of distributed systems (Dertouzos, 1991:29-40). The 1990 annual survey of 66,000 Datamation magazine subscribers reveals that the widespread applications of communication and information technologies are primarily due to the integration and networking of these technologies (Pinella, 1990:43).

A modem, microcomputer, telephone line, facsimile (Fax), copier, and integrated software program allow workers to communicate with others in diverse locations through networks (Crume and Maddox, 1990:27). About thirty-eight percent of all American workers used some form of communication and information technologies on their jobs during 1992 (Halal, 1992:10-15).

Among the most popular systems reported by survey respondents are personal computers, facsimile (Fax), data processing, and micro-mainframe links; the least popular are videoconferencing networks and links between local area networks (LANS) (Faerstein and Levine, 1988:38). Avner, Smith, and Tenczar (1984) conclude from an analysis of 143 groups that are responsible for the development of curriculum and classroom instruction that the use of an appropriate interactive software tool and the developer's knowledge of and

skills with systems, software, and procedures are the most important factors in predicting the productivity, the quality, and the efficiency for using these technologies.

Communication and information technologies cannot enhance organizational processes, productivity, and quality of work if they are not used (Bracey, 1988b:70-71). A study of two thousand United States companies that had implemented communication and information technologies reveals that forty percent had not achieved intended results, although less than ten percent of the failures were scored as technical (Bikson and Gutek, 1984). A survey of Chief Executive Officers from industry finds less than half feel their companies receive above average returns on technologies (Lane and Hall, 1987).

Some studies imply that a large segment of society has a less than desirable attitude concerning the applications of technologies in education, industry, and the military (Jay, 1981:47). The overall consensus of these studies is that many people are suspicious of technologies (Lewis, 1988:5-12). Literature continues to interpret this concept through the use of terms such as "computerphobia," "micro-anxiety," "computer anxiety," and "technostress" (Bracey, 1988a:527).

Zuboff (1982) emphasizes that workers often feel that the introduction of technologies preempts their judgment and offers no room for individual decision-making. A major study of the introduction of technologies into the workplace suggests that one in three workers will resist or be skeptical of technologies rather than be advocates of their applications (Zemke, 1984).

The basic characteristics of the work atmosphere in today's advanced technical society include the following: the polarization of the workforce into "expert" and "non-expert" sectors; the reinforcement of sex, age, and race segregation; the erosion of internal career ladders; the increased importance of credentials; the restructuring of skills; and the establishment of workplace authority from shown expertise and certified credentials versus industrial seniority and rank status in the workplace (Zuboff, 1991:66-94). Women, minorities, and the aged are disproportionately found in the "non-expert," de-skilled, ill-paid jobs, and the underemployed and unemployed ranks (Firestone, 1992:363-381).

Worker Critical Skills

The third area of the literature review involves worker critical skills for communication and information technologies. If the development of human resources does not adapt to the rapidly changing applications of technologies and dynamic skill requirements of today's organizations, then workers will be unskilled, underprepared, and not empowered for today's advanced technical workplace (Goldstein and Gilliam, 1990:138-141).

In a study of 250 small companies conducted by the Roper Organization for the Center for Workforce Preparation and Quality Education, twenty-nine percent of the firms said that they had problems finding employees with adequate skills (Szabo, 1990:38-40). Atkins and Georgantzas (1989) conducted a survey that asked respondents to rate twenty-seven areas of knowledge, skills, and abilities in terms of degree of importance for entry level positions in advanced technology industries. Results provided insights into the

complex interrelationships among the perceptions of workers and managers, areas of desired competencies, and organizational processes.

Hodson (1988) notes that "skill restructuring" and "skill disruption" often occur as organizations restructure around systems, integrated networks, and software of advanced technology. Also, Hallett (1991) emphasizes that traditional work skills usually become obsolete because of technological and organizational changes in the workplace. Workers must gain technology literacy, which is understanding technology and its dynamics, the opportunities it offers, and its impact on organizational processes, design structures, and people (Gordon, 1991a:27-35).

With advanced technology, information processing systems, and integrated networks of distributed smart systems, workers enhance organizational processes and productivity and also add a competitive advantage through more knowledge work, creativity, and anticipatory activities within the workplace (Howell and Cooke, 1989:180-182). This capability demands a technology literate worker with the critical skills of willingness/ability to learn, information synthesis, communication, and intellectual comprehension than formerly required in the workplace (Carnevale, 1991).

In his survey of the utilization of technologies by small contractors and factors that hinder more comprehensive applications, Skibniewski (1990) infers that successful implementation and use of technologies depend on knowledgeable users and compatible systems, software, procedures, and training. Beer, Eisenstat, and Spector (1990) conclude from a four-year study of organizational change at six large corporations that competencies such as job knowledge,

intellectual skills, and interpersonal skills are necessary for change to occur. In a 1991 survey of two thousand secretaries and one thousand managers in the United States and Canada using communication and information technologies, ten percent report the added responsibilities of working with facsimiles (Faxs), desktop publishing, and networks while managers report doing more of their own keyboarding and formatting documents (The Secretary, 1991:34-37).

Changes in technology in the workplace increase demands on the knowledge, skills, and attitudes of workers (Sims and Serbrenia, 1991:71-82). Smart communication and information technologies raise the complexity of the skills required by knowledge/information workers (Durand, Bennett, and Betty, 1990:117). In case studies of automation in nine different organizations, Zuboff (1988) reveals that instead of simple procedural tasks, workers become responsible for inferences, diagnoses, judgment, and decision making, often under severe time constraints.

Zuboff (1991:68 and 70) proposes that the most fundamental way that working with communication and information technologies differs from noncomputerized work is that it is more abstract, requiring knowledge work, critical thinking, and intellectual skills. Cetron and Davies (1989b) state that by the year 2000, forty-four percent of the labor force will be involved primarily in collecting, analyzing, synthesizing, structuring, storing, or retrieving information as a basis of productivity in the workplace.

Brand (1990:41) emphasizes that the primary requirement in today's workplace is the ability of the worker to access all types of systems, software, procedures, and training in an advanced technical environment to obtain the

desired information, data, and expert knowledge. Today's focus should be on workers' acquiring specific skills for lifelong learning, willingness/ability to learn, information processing, and proficiency with advanced technical systems, software, and procedures (Caissy, 1989:42-45).

Adler's (1986) study of automated banking found that employees were required to have new skills such as understanding processes, synthesizing information, reasoning, and knowledge of systems, software, and procedures because workers assumed greater responsibility for productivity and costs of operations. A 1990 Training magazine survey of industry reveals that understanding information, recognizing concepts, synthesizing implications, decision making, motivation, goal setting, and creativity are all skills emphasized in corporate education and training for technologies to empower today's worker for greater productivity (Gordon, 1990:66). Most jobs in the advanced technical workplace in the next ten years will demand more workforce education and training for technologies with higher information processing, communication, and reasoning abilities, according to a 1987 study by the Hudson Institute for United States Department of Labor (Bernardon, 1989:30).

Workforce Education and Training Requirements

The last area of the literature review is workforce education and training requirements for technologies. More than ever, senior decision-makers, leaders, and supervisors will need to plan for effective workforce education and training during the modernization of institutions (Argyris, 1990:45-48). The success of the United States in global economics and security depends on the ability of the

nation to educate and train the workforce--a challenge that will be more critical and difficult during the 1990's (Wright, 1990:85).

Studies by Flynn (1988), Levin (1987), Lewis (1988), Majchrzak (1988), Pasmore (1988), and Howard T. Smith (1990) have shown that the more workers are educated and trained in technologies, the more likely they are to use them efficiently and effectively. A study by the National Association of Manufacturers found that up to forty percent of United States' firms that claim efforts to upgrade workplace technologies have not been fully successful because of the low level of education of the workforce (Weisman, 1991:5). Hakken (1991) stresses the urgent need to understand the critical issues of curriculum and budget requirements in support of workforce education and training for technologies.

The effectiveness of workforce education and training for technologies is based upon the capability of education and training to continually empower people with a means to influence their career progressions, socio-economic expectations, and lifelong goals (Thurow, 1992:17). Empowerment occurs when cognitive, motivational, and other changes enable individuals to help themselves gain greater control over their careers and lives (Grensing, 1991). Education has always been perceived by individuals as a means of achieving upward mobility, both socially and economically (Jamieson and O'Mara, 1991).

The education system affects the daily lives of more Americans than any other social organization (Galbraith, 1992:17-19). However, educators have yet to take the problem of workforce education and training for technologies seriously in the modernization of the workplace (Szabo, 1992:34).

Technological illiteracy is more often treated as a personal misfortune rather than as a real and serious threat to the nation's standard of living and well being within the world (DeGreene, 1991:64-79). By the year 1995, six out of ten jobs will require the employee to be technology literate (Steinburg, 1992).

Many businesses are sending their employees back to community colleges to gain the knowledge and skills required to optimize the use of technologies at work (Holushia, 1991:30). Employers nationwide are spending over $210 billion a year to educate and teach workers the necessary knowledge, skills, and attitudes for the advanced technical workplace (Gardner and Marker, 1991:21). Millions of workers participate in lifelong learning in corporate training or universities (Monthly Labor Review, 1992:47).

According to the Training Magazine's 1991 Industry Survey Report, United States' companies employing more than 100 workers invested a total of $43.2 billion in training during 1991. Employers provided formal training for 36.8 million workers. Training departments of companies spent a total of $8.7 billion on contracted training such as seminars, software tutorials, and packaged training programs (Gordon, 1991b:37-45).

In a six-year study of managers at Honeywell Corporation completed in 1985, twenty percent of the critical skills were acquired in formal education and training courses (Malcolm, 1992:57-61). Almost four-fifths of 455 companies surveyed by Olsten Forum on Human Resources Issues and Trends (1991) had in-house training facilities or skills development programs that included employee-to-employee instruction, self-training manuals, and software tutorials. Seven out of ten companies used outside training vendors and consultants.

One of the implications of interviews with 786 adults stratified according to nine age strata, three socioeconomic classes, two genders, and three working sectors was that adults in the 1990's must be made aware that continuous vocational, technical, and occupational education (E-VTO) is required for them to remain technology literate in the advanced technical workplace (Riverin-Simard, 1990:140). Sixty percent of the respondents (n = 1003) in a 1990 survey by the Roper Organization said that most of today's workers will not be able to keep up with technological changes in the future (Szabo, 1990:38).

Workers already in the workforce are most likely to seek education and training to stay competitive; the unemployed (particularly women, minorities, and immigrants) tend to seek training in technologies to learn a particular application or program (Brunet and Proulx, 1989:81). A 1991 survey by Towers Perrin Company reveals that skill-based pay epitomizes the integration of continued learning with work requirements in participatory learning-intensive workplaces (Towers Perrin, 1991). Incentive pay systems, performance appraisals, and career planning are all being linked and used to reinforce workforce education and training for technologies (Bushnell, 1988:17-22). The Learning Enterprise, a book based on a study by United States Department of Labor (1989), documents how learning on the job contributed more than half of all improvements in the nation's productive capacity (Stanton, 1989:3).

Traditional instructional methodologies no longer serve today's needs (Coates and Jarratt, 1990:24). Education and training must go beyond offering the basic skills classes; the curriculum and instruction of education and training must be tailored to fit the needs of workers in an advanced technical workplace

(Marsick and Watkins, 1992). A new post-industrial lifelong learning enterprise is attempting to expand the experience of learning to all aspects of life and to meet the workplace needs of industry, government, and the military (Leclerc, 1991:39). The lock-step sequence of education, employment, and retirement is obsolete; people must have assess to education and training at various stages of their lives to start second, third, or even fourth careers (Moen, 1992).

Summary

The review of literature supports the need to identify the workforce education and training requirements for communication and information technologies that form the key elements of a human resources development plan. Collectively, the literature emphasize the enormous primacy of understanding the concepts and implications concerning communication and information technologies used for administrative purposes and for the development of instruction: (1) applications, (2) worker critical skills, and (3) workforce education and training requirements.

The understanding of the implications in the applications of state-of-the-art communication and information technologies in the advanced technical workplace is more than just knowing systems, integrated networks, software, and procedures. It also involves an analysis of institutional mission, organizational processes, and workplace requirements. Well-designed applications of technologies can not only enhance accomplishment of the mission but can also empower workers to do their best.

Willingness to learn and information processing skills continually surface as critical skills necessary for workers to use communication and information technologies, to move up career ladders, to improve socio-economic status, and to achieve lifelong goals in the advanced technical era. In order to be willing to learn new technologies, each worker in today's workplace must understand that the benefits obtained from the applications of these technologies outweigh the burden of learning something new.

The real challenge of the arrival of communication and information technologies in the workplace is the importance of human resources development. Meeting the learning needs of workers is a fundamental tenet of vocational, technical, and occupational education (E-VTO) in today's new society of information, electronics, and advanced technology.

An abundance of studies indicates that workers need education and training in communication and information technologies. However, little descriptive research and only a few systematic studies have been undertaken to identify the workforce education and training requirements for these technologies. The main research questions in most studies appear to address potential relationships of applications of technologies to adult learning, critical skills, value of education and training, and worker acceptance of technology.

From the literature, the workforce education and training requirements for communication and information technologies can be grouped into four essential areas of consideration: (1) strategy, (2) scope, (3) standards, and (4) primary critical tasks. These areas represent the basis for the key elements of a human resources development plan.

Chapter 3

METHODOLOGY

A developmental scientific methodology was used to identify the workforce education and training requirements for communication and information technologies that form the key elements of a human resources development plan at the United States Army Aviation Center (USAAVNC) for the 1990's. The Major Applied Research Project (MARP) involved a working understanding of the USAAVNC career education and technical training mission and a conceptual knowledge of the modernization issues of the development of organization and human resources. These issues included total quality management, strategic planning, demographics, workers' skills, technology literacy, applications of technologies, and workforce education and training for technologies in today's advanced technical society.

Research Design

Literature, previous studies, and plans were reviewed concerning the implementation of communication and information technologies and programs of human resources development that accompany modernization. The selection of USAAVNC as the focus of this investigation was for several reasons. First, USAAVNC is similar to the other fifteen USATRADOC institutions that are located nationwide to provide career education and technical training to Army personnel. Second, the Army often prefers to deliver new contemporary

technologies to USATRADOC institutions before releasing it to other Army organizations that are located worldwide. Finally, the most important reason for selecting USAAVNC was the researcher's primary area of responsibility that allowed ease of access to information and data through key personnel, a group of experts, and a survey sample of the USAAVNC workforce.

Procedures

The following procedures were used:

A. Information was collected from an overview of relevant articles, journals, and literature to acquire an understanding of the significant concepts and potential implications. Previous studies and plans were investigated for the implementation of communication and information technologies and the programs of human resources development that accompany modernization. Plans for implementation of these technologies in an advanced technology workplace were analyzed.

B. Needs assessment was conducted to identify the applications of communication and information technologies, worker critical skills, and workforce education and training requirements.

   1. Key personnel were interviewed who knew the USAAVNC mission, human resources development programs, and plans to modernize. (The four interview questions are in Appendix E).

   2. A group of experts was convened from the USAAVNC staff who understood the USAAVNC mission, envisioned applications of technologies used for administrative purposes and for the

development of instruction, worker desired critical skills, and workforce current and future education and training requirements in the USAAVNC modernized workplace. Experts included designated key administrative support workers, supervisory personnel, and project action workers--education specialists and training developers. These discussions by a group of experts elaborated and expanded on the interview results and provided practical rationale to the analysis.

3. A sample of the USAAVNC workforce population was surveyed in the areas of applications of communication and information technologies, worker critical skills, workforce current education and training requirements, and workforce characteristics in the USAAVNC workplace. (A copy of the survey questionnaire is in Appendix F).
4. The data collected from interviews, discussions, and survey was analyzed using developmental scientific methodology to address the four major research questions.

C. Analysis of information was submitted to the USAAVNC staff for review and comment. Final substantive information was disseminated to USAAVNC senior leaders, USATRADOC Headquarters staff, and selective Army organizations to provide workforce education and training requirements to make policy and program planning decisions in human resources development and improve workforce education and training for technologies.

Data and Data Resources

Diverse views, information, and data about technologies, critical skills, and education and training requirements were obtained through key personnel interviews, discussions by a group of experts, and a survey of a sample of the USAAVNC workforce population. The information and data included (1) answers to interview questions, (2) significant concepts and implications of discussions from a group of experts, and (3) responses to survey questionnaire.

Key personnel from USATRADOC and USAAVNC staff provided information during interviews about (1) the uses of communication and information technologies; (2) the applications, programs, and plans for these technologies; (3) the unique worker desired critical skills; and (4) the workforce education and training requirements at USAAVNC. Key personnel included designated education specialists, training developers, information management and technology specialists, and their supervisors; directors, Personnel Department and Information Management Directorate at USAAVNC; and directors, Personnel Department and Information Management Directorate at Headquarters, USATRADOC.

The group of experts from the USAAVNC staff provided information about the USAAVNC mission and envisioned applications of technologies used for administrative purposes and for the development of instruction, worker desired critical skills, and current and future workforce education and training requirements at USAAVNC. Experts included knowledgeable key education specialists, training developers, administrative support workers, project action workers, and supervisory personnel. These discussions by a

group of experts elaborated and expanded on the results of the interviews and provided practical rationale to the developmental scientific methodology.

A survey of the workforce provided information and data in the areas of applications of communication and information technologies, worker desired critical skills, workforce current education and training requirements, and workforce characteristics in the USAAVNC workplace. The workforce sample included administrative support workers, supervisory personnel, and project action workers--education specialists and training developers.

Data Analysis

The diverse views, information, and data collected from interviews, discussions, and survey were used to address the four major research questions. Developmental scientific methodology was used to analyze the interview responses, group discussions, and responses to statements and written responses to open-ended questions of the survey questionnaire.

Significant concepts and implications were initially categorized from responses of key personnel to interview questions, discussions of a group of experts, and written questionnaire responses of the survey sample into key concepts or phrases. These were further refined into groups--applications of communication and information technologies, worker critical skills, workforce education and training requirements, and key elements of a human resources plan--that addressed the major research questions. This process of synthesis provided meaningful understandings for each particular major research question.

The combination of interview, discussion, and survey data contributed to more confidence in the validity of the results presented. Comprehensive and systematic developmental scientific methodology provided the best means to identify the workforce education and training requirements for communication and information technologies at USAAVNC.

Not only was it valuable to collect workforce characteristics to develop better knowledge of the workforce affected by modernization, but also as noted during the review of literature, previous studies, and data collection, assertions between workforce characteristics and the identification of workforce education and training could be made. Having the workforce characteristics available enabled the researcher to better realize the interpretations, conclusions, and recommendations from interviews of key personnel, discussions by a group of experts, and answers to the open-ended questions in workforce questionnaire.

Limitations

Of the sixteen USATRADOC education and training institutions, USAAVNC was the only institution that was studied. Whether the results are directly applicable to the other USATRADOC institutions or similar organizations may have to be determined through further study at these locations.

Of the communication and information technologies being implemented at USAAVNC, only those technologies used for administrative purposes and for the development of classroom instruction and flight training were investigated. Other communication and information technologies that are used in delivery and support of instruction at USAAVNC were not included in the MARP.

Key personnel, experts, and survey respondents may have interpreted the meanings and definitions of the applications of technologies and the worker critical skills differently in relation to their perception of the terms. Inadvertently, important applications or skills may have been omitted or grouped together from the interviews, discussions, and survey. The use of numerous open-ended questions inviting comments should have reduced this risk.

The Directorate of Training and Doctrine (DOTD), one of eight USAAVNC directorates, was the sample (n = 220) for the MARP survey because the DOTD workforce is representative in skills, knowledge, and abilities of the workforce (8500) that is expected to work with communication and information technologies to support the mission. A questionnaire response rate of 90 percent (220/198) should ensure that the sample results and findings are representative of the USAAVNC population (West, 1991:135). The survey sampling of homogeneous slices of the workforce was conducted rather than random sampling of the total workforce population (Guinn, 1990:66).

DOTD respondents in the survey sample were predominantly male (133), white not of Hispanic origin (131), over 36 years of age (152), and educated (113) with at least a college degree. Workers were grouped into three categories: administrative support (62), supervisory (32), and project action (93). This representation of the USAAVNC population reflected the personnel who are using the communication and information technologies for administrative purposes and for the development of instruction and curriculum. During the administration of survey questionnaires to DOTD, there was no intent to underrepresent any gender, race, age, job category, or level of education.

Chapter 4

PRESENTATION OF RESULTS

The results of this study were drawn from a combination of data collection techniques--key personnel interviews, discussions by a group of experts, and a workforce survey--used during the data collection from December, 1990, through March, 1991. The purpose of the study was to identify the workforce education and training requirements for communication and information technologies that form the key elements of a human resources development plan at USAAVNC for the 1990's.

First, the results of the review of plans for the development of organization and human resources that are being used to modernize the USAAVNC workplace with communication and information technologies are presented. Second, narrative comments and supporting quotations which were obtained from key personnel interviews and discussions by the group of experts are provided. Third, the results of the workforce questionnaire that was administered to 220 Directorate of Training and Doctrine (DOTD) workers at USAAVNC are presented.

Review of Plans

A review of the plans concerning the development of organization and human resources for communication and information technologies was conducted. The results of this review of planning documents were significant

concepts, thoughts, and phrases about applications of technologies, worker critical skills, and education and training requirements for technologies. The four categories for organizing these results were the following: (1) Army Modernization Memorandum, (2) United States Army Training and Doctrine Command (USATRADOC) Long Range Plan, (3) Directorate of Information Management (DOIM) Information Management Plan, and (4) Individual Development Plan.

Army Modernization Memorandum.

The Army Modernization Memorandum (AMM) provides a comprehensive strategy for the Army of the future. Senior Army leaders publish this policy document for the Department of the Army staff to develop supporting policies, programs, plans, and budgets. The AMM synchronizes future Army intent in war-fighting doctrine, leader development, organizational structure, material acquisition, and education and training of the Army workforce. The AMM focuses more on providing guidance to the Department of the Army staff in the Pentagon than to USATRADOC commanders and staffs when interpreting the mission into a plan of action with requirements for resources. The memorandum does, however, provide long range intent and broad scope to USATRADOC commanders and staffs that are located nationwide.

USATRADOC Long Range Plan.

The USATRADOC Long Range Plan (LRP) consolidates senior leaders' visions, strategies, policies, directions, and key events into a unified strategy statement. The LRP forms the foundation for the development of USATRADOC

programs and budgets within the Army. The plan articulates the intent of the AMM into the following USATRADOC strategy for the 1990's.

1. Automate the educational development process that allows determination of requirements throughout the Army.
2. Distribute lessons learned in near real time through an interactive network of data bases.
3. Embed integrated electronic/desktop publishing throughout USATRADOC to reduce publication time and costs.
4. Develop electronic media for accumulating and disseminating information throughout the Army.
5. Establish an integrated video-teleconferencing network for USATRADOC and the Army.

The USATRADOC LRP does not provide much information that contributes to the identification of the workforce education and training requirements for technologies. The plan contains a broad statement for the commanders of the sixteen USATRADOC installations to develop and incorporate a complete training strategy for their workforce--military personnel and Army civil service employees--as a part of the total Army objective to educate and train its workforce for technologies.

Directorate of Information Management (DOIM) Information Management Plan.

The DOIM Information Management Plan is used primarily at USAAVNC as an acquisition strategy for communication and information technologies where the directorates, departments, special staff, and separate commands submit their requirements for systems, software, procedures, and training and corresponding organizational designs. DOIM then merges these acquisition requirements into the single source document that is submitted to the headquarters of USATRADOC for approval and distribution.

DOIM information management and technology specialists make few changes to the input from the USAAVNC organizations and literally combine this input into one draft document with little change, comment, priority, or integration. The plan is not readily available for distribution or use by USAAVNC program planners or resource managers outside of the information management and technology staff to develop supporting plans and budgets. Requests by the USAAVNC staff for copies of the plan are often answered by "the plan is not completed yet" or "the plan is not approved by USATRADOC for release." This DOIM response limits the distribution of the plan and its use by planners as a credible source of information and guidance for the development of organization and human resources.

Individual Development Plan.

An Individual Development Plan (IDP) is a personnel management document that is used for the planning of human resources development of each Army civil service employee. The IDP is a written plan to help the worker set up reasonable goals, assess particular strengths and areas of improvement, and outline current contribution and future growth for individual development and career progression. The IDP is a process that includes both perspectives of the supervisor and worker that are considered as far as they are feasible within the organization.

The IDP process includes the following worker responsibilities:

1. determine exactly the status of the worker in specific knowledge and skills and career progression;
2. conduct a self-evaluation--input from supervisor and peers;
3. assess performance in present job as satisfactory or needs improvement;

4. consider long-term goals and develop short-term requirements for achieving goals;
5. establish and implement an individual professional reading plan;
6. determine strengths/weaknesses and work to improve weak areas;
7. pursue program with a positive attitude;
8. become aware of supervisor's and organization's goals;
9. understand the importance of personal choice, direction, and determination; and
10. take charge of situation, establish priorities, and set up timetable, and adhere to plan.

Key Personnel Interviews

Key personnel were interviewed in Winter, 1991, to answer the four questions about USATRADOC and USAAVNC missions, modernization plans, and requirements for human resources development. The following key personnel were included:

A. designated knowledgeable education specialists, training developers, information management and technology specialists, and their supervisors at USAAVNC and USATRADOC; and

B. directors, Personnel Department and Information Management Directorate, USAAVNC, and Directors, Personnel Department and Information Management Directorate, Headquarters, USATRADOC.

During the interviews, key personnel provided information about (1) the uses of communication and information technologies; (2) the applications, programs, and plans for these technologies; (3) the unique worker desired critical skills; and (4) the workforce education and training requirements at USAAVNC. (The four interview questions are in Appendix E.) These interviews provided a comprehensive holistic focus to the developmental scientific methodology.

The results of the interviews of key personnel interviews were significant concepts, thoughts, phrases, and quotations. These results were organized into the four categories of the interview questions concerning communication and information technologies.

The first question asked key personnel was **"Why use communication and information technologies at USAAVNC?"** All key personnel remarked that the emphasis on using communication and information technologies can be attributed to the interest and involvement of the USAAVNC command group and directors. The prevailing response was that these technologies were being "forced" into the USAAVNC organizations as a high visibility action by senior leaders at USAAVNC. Most key personnel said, "I was given the equipment and told to get my people working with it." Predominant comments by key personnel emphasized that without this sustained interest of the senior leaders, the applications of these technologies would not have been introduced as comprehensively and with such a sense of urgency as they were.

Many key personnel indicated that they were not strong advocates of using these technologies because they were generally not aware of what these technologies could do for them at work. The predominant comments by key personnel focused on the issue that it is difficult to answer this interview question when very little is known about communication and information technologies and the contributions that they can make in the workplace.

Beyond the senior leaders' influence, there were other factors that forced the use of communication and information technologies in the USAAVNC workplace. First, a USAAVNC atmosphere existed of repeated reductions of

resources by the Department of the Army staff that caused many supervisors to see the use of these technologies as a means to maintain at least current productivity and quality of work. Efficiency, convenience, and time saving were the attributes used often to justify applications of these technologies.

Second, other organizations external to USAAVNC that were using these technologies also demanded that the USAAVNC workforce use these technologies in developmental activities, planning, coordination, and decision-making as routine policy in conducting business with them. The implementation of total quality management was urging decentralization of authority and responsibility for these technologies. Respondents often stated, "People and organizations outside of USAAVNC have these technologies and are telling us to use them."

Third, the applications of these technologies in the workplace was also a matter of professional pride to education specialists and training developers in classroom instruction and flight training. Their supervisors did not want to be embarrassed by their not keeping up with contemporary technologies with so much senior leaders' commitment. Acquisition of systems and software had strict schedules that had to be followed to ensure that funding was spent before the end of the fiscal year. Supervisors were held accountable on their annual performance appraisal for successful compliance to the schedules.

Finally, inadequate funding to acquire the number, type, and quality of technologies was the major negative factor that worked against the effective use of these technologies. Consequently, limited availability of systems, software, procedures, and training often discouraged many workers and

restricted the contribution of technologies to enhanced accomplishment of the mission.

The applications of communication and information technologies required a new learning experience for many workers who felt that the "old way" of doing their work was just fine. Most key personnel emphasized that workers must be convinced that the education and training for technologies is going to be worth their personal effort and time to learn how to use them at work.

Significant key personnel comments on **"Why use communication and information technologies at USAAVNC?"** were as follows:

1. "These systems are coming to USAAVNC and we must use them."
2. "Software programs are more user friendly."
3. "Costs of technologies have decreased and benefits have increased."
4. "Computers combined with networks make critical information more accessible to decision-makers."
5. "Work is getting more complex."

The second question asked key personnel was **"What are the applications, programs, and plans for communication and information technologies?"** Most key personnel emphasized these applications of communication and information technologies:

1. Word processing on a desktop computer
2. Facsimile (Fax)
3. Spreadsheets
4. Phone system, especially voice mail
5. Storage/retrieval of information
6. Networking of systems, especially E-Mail
7. Scheduling
8. Videoconferencing
9. Development and management of instruction
10. Briefings and presentations
11. Tracking projects both for instruction and aircraft development
12. Data base management
13. Digital color copier

Many key personnel referred to the (1) Army Modernization Memorandum (AMM), (2) USATRADOC Long Range Plan (LRP), (3) Directorate of Information Management (DOIM) Information Management Plan, and (4) Individual Development Plan (IDP). The Army Modernization Memorandum was often described as too broad and strategically oriented to be useful as a practical guide in lower levels of management.

Key personnel asserted that the USATRADOC Long Range Plan provides some guidance on the scope of the applications of communication and information technologies at the sixteen USATRADOC installations but requires significant update to be applicable to today's requirements. Most key personnel indicated that they were aware of the DOIM Information Management Plan but complained that the plan is not readily available for staff planning activities outside the DOIM staff of information management and technology specialists.

Key personnel could not recall any human resources development plan published by management for the USAAVNC workforce. The Individual Development Plan was consistently mentioned as the only developmental plan that is functional for each Army civil service employee, but it is more of a personnel management document. Military personnel had no similar personnel management document for their individual development and career progression.

Significant key personnel comments on applications, programs, and plans for communication and information technologies were as follows:

1. "Study should be conducted of each organization based on mission to determine applications actually needed."
2. "We are given systems and software to use without formal training."
3. "Does not appear to be planning for arrival and use of systems."
4. "No comprehensively specified education and training plan exists."
5. "Systems are not used to full potential."

The third question asked key personnel was **"What unique worker specific critical skills or competencies should be recognized as required for the USAAVNC workforce to use communication and information technologies?"** Key personnel already working with communication and information technologies stressed the importance of intellectual skills that are required for understanding information, recognizing concepts, synthesizing implications, organizing efforts, and solving problems. Other skills include willingness/ability to learn; basic computer skills; and knowledge of systems, software, and procedures. These technologies have shifted the emphasis in the workplace toward more teamwork through integrated networks of distributed systems.

Most key personnel emphasized these specific critical skills for technologies:

1. Typing/keyboarding
2. Basic computer skills to produce something from systems
3. Computer literacy
4. Word processing in preparing correspondence--documents, plans, reports
5. Networking with other distributed systems/organizations
6. Entering data in spreadsheet and data base
7. Managing a data base
8. Intellectual skills
9. Willingness and ability to learn
10. Automating data, collection, reduction, and evaluation techniques of research studies
11. Preparing presentations and briefings
12. Research techniques
13. Monitoring progress, suspense actions, and milestones
14. Diagnostic skills to solve problems in the office

Significant key personnel comments on specific critical skills that should be recognized as required for the USAAVNC workforce to use communication and information technologies were the following:

1. "Being able to grasp basic concepts and apply them to get the job done."
2. "Administrative skills--typing, formatting documents, and storing info."
3. "Being able to understand technical and often confusing documents that come with systems and are supposed to help you use them."
4. "Development of aviation education and training using these technologies."
5. "Spreadsheets and models for research and analytical purposes."

The fourth question asked key personnel was **"What should be the workforce education and training requirements for communication and information technologies at USAAVNC?"** Most key personnel emphasized a distinction between education and training of the USAAVNC workforce for communication and information technologies. Education is the process of the integration of higher-order, cognitive, affective, and psychomotor competencies. Training is the process through which the workers learn technical skills for systems, software, or procedures to accomplish specific tasks.

Workforce education and training requirements for technologies expressed by key personnel were related to three areas--scope, standards, and primary critical tasks requirements in the workplace. There was unanimous agreement that education and training requirements were not adequately defined for the current workforce, not to mention future needs. Any outline, specification, or codification of education and training requirements would be an improvement over the current situation.

Significant key personnel comments on workforce education and training requirements for communication and information technologies at USAAVNC were the following:

1. "Nonexistent. Definitely lack of formal education and training requirements."
2. "It is important to show workers that it is worthwhile to learn these new systems."
3. "Most people are too lazy to learn on their own."
4. "People are not required to be proficient on systems."
5. "Current work environment feels education/training not necessary."
6. "Training in software application."
7. "Continuous classes and updates on new hardware and software."
8. "Everyone should have basic computer skills and knowledge."
9. "I type and format documents which my secretary did before."

The predominant education and training requirements for technologies expressed by key personnel were as follows:

A. Scope

1. Establish centralized source of information and instruction that covers all communication and information technologies available to the workforce
2. Configure communication and information technologies to facilitate work requirements so that workers can increase productivity in nonroutine functions
3. Link knowledge and proficiency on these technologies to workers' performance evaluation
4. Establish mandatory education and training in communication and training technologies that relate to the position descriptions of workers
5. Provide opportunity, time, and money for workers to attend education and training
6. Encourage workers to participate in training that supports the organization's mission rather than merely allowing workers to go to training that they want to attend
7. Synchronize education and training to be timely with the arrival of systems, software, and procedures in the workplace
8. Involve workers with these technologies as early as possible, preferably in planning prior to the arrival of their integrated work stations
9. Provide vendor training during the implementation of the technology and then schedule follow-up training on systems and software upgrades
10. Educate workers on the capabilities of these technologies to the individual and see the potential and value-added to their activities in the workplace
11. Create workplace conditions that help the worker want to learn these technologies and see value in learning

B. Standards.

1. Establish standard education and training requirements that are fully understood and accepted by the workers as part of the agreement to occupy their position in the workplace
2. Design education and training curriculum that addresses workers' knowledge, skills, and abilities so that the training is job relevant, gives positive feedback, and encourages self-confidence and self-directed learning in the workers
3. Build training on elements familiar to the workers from past learning and tasks that practice problem-solving in workplace
4. Train workers in a building block approach while learning skills in a sequential order
5. Allow workers to gain complete mastery of skills from previous training before moving on to subsequent training
6. Provide education and training that is self-paced and individualized instruction
7. Eliminate or reduce timed-pressured situations to the extent possible
8. Provide workers with equal opportunity, time, and resources to practice their newly acquired skills in their workplace
9. Establish a special task force which is comprised of key personnel--administrative support, supervisory, and project action--to help establish standards
10. Make available special services of experts in academia, industry, and government to contribute to standard staff planning, decision-making, and on-site training of communication and information technologies

C. Primary Critical Tasks.

1. Typing/keyboarding.
2. Processing/retrieving information from networks/data bases.
3. Word processing.
4. Education and training developmental activities.
5. Aviation training systems development.
6. Diagnostic skills to interpret situations and problems.
7. Project management for the development of instruction and aircraft/systems.
8. Integration and priority of workload.
9. Networking with distributed systems.
10. Techniques for research/analytical models/spreadsheets.
11. Preparation for electronic briefings/presentations.
12. Coordination with other organizations using technologies.
13. Administrative/support activities.

Expert Group Discussions

A group of experts from the USAAVNC staff was convened six times from December, 1990, through March, 1991. Members of this group understood the USAAVNC mission, applications of communication and information technologies, worker critical skills, and workforce education and training requirements. Experts included key information technology managers, administrative support workers, supervisory personnel, and project action workers--education specialists and training developers.

The results of the discussions of a group of experts were significant concepts, thoughts, phrases, and priority lists. The three categories for organizing these results concerning communication and information technologies were the following: (1) applications, (2) worker critical skills, and (3) workforce education and training requirements.

Applications of Communication and Information Technologies.

Three significant developments are the driving forces behind utilization of contemporary communication and information technologies in the Army school system. First, the Army is experiencing an advanced technology revolution extending from aircraft and aviation systems to office automation. Second, the costs of advanced technology are more reasonable. Third, the quantity and quality of software applications are increasing. Even more applications must be anticipated at USAAVNC with the next wave of state-of-the-art communication and information technologies for the 1990's.

Discussions by a group of experts revealed the following desired applications of technologies: desktop computers, integrated networks of distributed systems, data bases, spreadsheets, word processing, graphics, controlling, electronic filing, videoconferencing, problem solving, electronic briefings, planning, forecasting, monitoring work, project management, and processing and retrieving information. Experts also expressed concern for emerging advanced technologies such as artificial intelligence, interactive software, telecommunications, speech processing, and microwave technology.

An Optical Reader (document reader) has been made operational and available for use by the USAAVNC staff in the DOIM building to reduce the requirements for manual typing of lengthy documents into computer or electronic files. A Kodak video/electronic briefing capability has been installed in the USAAVNC main conference room to support video/electronic presentations to the command group and visitors. An upgrade to the local area network (LAN) has been implemented to allow the networking of distributed systems.

Limited organizational development plans are available for modernization of the USAAVNC workplace for communication and information technologies. These include (1) Army Modernization Memorandum, (2) USATRADOC Long Range Plan, and (3) Directorate of Information Management (DOIM) Information Management Plan. The DOIM Information Management Plan is not current to support the modernization of the USAAVNC workplace. No human resources development plan exists for the USAAVNC workforce, but there is the Individual Developmental Plan for planning and allocating resources to train each Army civil service employee.

Supervisors must be concerned with the risk that desktop computers are often installed in the office as stand-alone work stations and tend to divert the attention of users away from their primary job. Training developers and education specialists develop classroom instruction and flight training in teams and have a need to share information in a timely manner. Unless closely controlled, the focus of these workers who use communication and information technologies rapidly turns to organizational processes and personal projects which are not related to the mission related tasks. The increased productivity which is so frequently achieved by the use of these technologies can be often reduced by the extra labor and costs that are involved in the operation and maintenance of technologies.

Integrated networks of distributed systems provide the means for organizations to coordinate requirements, documents, and decisions concerning the development of classroom instruction and flight training. Workers can share these networks daily to exchange data, distribute results, and gain access to tutorials, data bases, interactive software, and distributed systems. Networking of distributed systems supports improved planning and decision-making through ease of access to the networks by both worker and supervisor.

Software features of networks should be menu-driven and should not require any prior knowledge of software programming. On-line data bases are primarily awkward to manipulate, and the search process to obtain information from data bases is often tedious, time-consuming, and expensive.

It is very important to keep the use of text-based authority or authoring software simple, which allows for the efficient development of aviation

instruction. Software terminology and procedures need to be coordinated with users and kept to standards. Confusing software commands or instructions should not be used in order to ensure that the use of software is more acceptable to user. Verification of input into the software should be requested so that critical errors in development of instruction and curriculum can be prevented.

A good software program should supply formatting templates for documents to help workers easily position text, files, and graphics from many sources into a single electronic file. Powerful and user-friendly desktop publishing features are essential for files, graphics, documents, and briefings with tools like search and change, block move and copy, cut and paste, and edit and view. The ability to quickly set and change layouts and paragraph styles throughout a document is important. Good drawing tools and clip-art library can greatly improve the appearance of a graphic, document, or briefing.

Integrated videoconferencing networks are often promoted as a substitute for official travel to conduct government business. Workers normally enjoy travelling and like the personal contact with colleagues with whom they ordinarily coordinate on the telephone to accomplish the mission. The substitution of face-to-face meetings by videoconferencing networks is often considered a threat by education specialists and training developers because they feel that complex issues concerning instruction development cannot not be adequately resolved through videoconferencing. However, this application allows wider participation in developmental activities, resolution of issues, and decision-making by providing the means for larger numbers of specialists, developers, and supervisors to interact while remaining in their workplace.

Final consensus of the discussions by a group of experts revealed the following key applications in order of priority for communication and information technologies to support administrative purposes and the development of classroom instruction and flight training:

1. Word processing
2. Activities in the development of education and training
3. Processing/retrieving information from networks/data bases
4. Development of aviation training systems and flight simulators
5. Integrated work stations
6. Voice mail on the phone system
7. Integration and priority of workload
8. Secure facsimile (Fax) for classified documents
9. Research/analytical models/spreadsheets
10. Briefings/presentations preparation
11. High quality, color, laser printer
12. Document reader (optical scanner)
13. Computer-assisted administration of survey questionnaires
14. Integrated text, graphics, and visual (desktop/electronic publishing)
15. Telecommunications software/protocol
16. Coordination with other organizations with technologies
17. Administrative/support activities

Worker Critical Skills.

Many worker critical skills have been identified for communication and information technologies. The specific profile of these skills varies among different categories of USAAVNC personnel--administrative support, supervisory, and project action. These military personnel and Army civil service employees must work with these technologies using organizational processes for the purposes of the USAAVNC workplace.

Workers who are responsible for administration and the development of aviation instruction must have the skills associated with teamwork and partnership for the accomplishment of the USAAVNC mission. These skills demand greater cooperation, communication, commitment, and intrapersonal

skills. A supervisor of these workers should become less of a decision-maker and more of a facilitator and provider of resources to accomplish the mission.

The critical skills for administrative support workers include willingness/ability to learn, processing/retrieving information, typing/keyboarding, word processing, electronic mail, networking with data bases and desktop computers, electronic filing, and diagnostic skills. Supervisory and project action personnel should have these additional critical skills: electronic briefings, organizing/monitoring work, planning, problem solving, research techniques, data manipulation, budgeting resources, forecasting, and videoconferencing in networks.

Many discussions focused on the issue of what basic computer skills are. Final consensus defined basic computer skills for the purposes of the workplace as typing/keyboarding, desktop publishing, networking distributed systems, and processing information--retrieve, store, manipulate, control, and circulate.

Final consensus of the discussions by a group of experts revealed the following critical skills in order of priority for communication and information technologies to support the conduct of administrative purposes and the development of classroom instruction and flight training:

1. Word processing
2. Basic computer skills
3. Developmental activities using technologies for aviation instruction and flight training technologies
4. Processing/retrieving information from networks/data bases
5. Integrated work stations activities
6. Secure facsimile (Fax) operation for classified documents
7. Models/spreadsheets research/analytical
8. Briefing/presentation skills
9. Administration of computer-assisted survey questionnaires
10. Integrated text, graphics, and visual (desktop publishing)
11. Telecommunications software/protocol
12. Coordination using technologies with other organizations

Workforce Education and Training Requirements.

Scarce USAAVNC mission resources must be used to train workers for communication and information technologies. The USAAVNC Training Manager has a general policy and some guidelines in the standard operating procedures that are oriented toward workers attending formal classroom instruction at local colleges or contracted training at USAAVNC. The Training Manager knows how to establish education and training of workers for micro-computers on a case-by-case basis. However, it is more often the situation that workers are expected to train themselves for more complex systems, software, and procedures using operator manuals of the separate systems and hands-on experience on work tasks.

Education and training for sustainment of an acceptable level of technology literacy for the workforce must be an integral part of the applications of communication and information technologies. Workforce education and training must be more job-related and supervisor-guided that use some form of embedded or modified on-the-job training with an intelligent, interactive software program. Education and training for technologies must be included in all types of the tasks of administrative support, supervisory, and project action.

The level of job competency and proficiency will determine the scope and type of education and training that workers should receive for technologies. Education must be more focused, efficient, and effective through individualized programs to meet the needs of each worker in the workplace.

Workers must be able to discuss career and life style goals with their supervisors and trainers who are responsible for getting workers trained in technologies. The supervisors and trainers must be able to help the worker(s) map out plans for a sequence of self-directed learning projects. Each plan should be an identification of learning needs that are linked with applicable learning resources through on-line learning systems and networking of systems.

Some individuals felt strongly that workers should not be allowed to enroll in education and training just because of their personal desire to learn about these technologies. Workers should only be enrolled in education and training for technologies paid by government funds when they have access to these technologies in the workplace and a specific work assignment that requires application of newly acquired skills to support the mission. Workforce education and training for technologies at USAAVNC must also focus on employee motivation, attitude adjustment, and planting new ideas or concepts to compliment specific technical skill building for technologies.

Discussions revealed that training for technologies should be job related. Education and training should be accomplished in a building block approach while individuals learn skills in a sequential order. Workers should be given equal opportunity and time on systems, software, and procedures to practice acquired skills in their workplaces.

User groups should be formed in workplaces to share common applications of communication and information technologies and work problems using these technologies. A worker who is experienced in the use of technologies should be designated as a trainer and be made readily available to

co-workers to answer specific questions and problems concerning systems, software, procedures, and training. One to two days of orientation in technologies toward operation and maintenance should be planned during implementation.

Discussions also revealed that site visits by supporting contractors should be scheduled periodically throughout the year for training refreshers. Letters or flyers should be published for the workforce that provide updated information on enhancements of systems, software, procedures, and training. Where possible, extensive use should be made of operator's manuals, software tutorials, and training disks.

Final consensus of a group of experts revealed the following workforce education and training requirements in order of priority for communication and information technologies to support administrative purposes and the development of classroom instruction and flight training:

1. Training in technologies as soon as assigned
2. Standard education and training to meet job requirements
3. Basic computer skills training in small groups
4. Advanced computer skills training on an individual basis when and by type needed
5. Designation of technologies subject matter experts as trainers who can train others when needed for type application
6. Training in developmental activities that require the use of technologies
7. Processing/retrieving information from networks/data bases
8. Use of integrated work stations
9. Briefing/presentation skills
10. Training in desktop publishing
11. Training in telecommunications software/protocol
12. Training for management in applications of technologies
13. Training be job related
14. Training of skills in a building block sequence
15. One-to-two days of orientation of technologies

Workforce Questionnaire

A questionnaire was developed to identify workforce education and training requirements for communication and information technologies. The instruments contained twelve questions about communication and information technologies for administrative purposes and the development of classroom instruction and flight training and five questions about workforce characteristics. (A copy of the questionnaire is in Appendix F.) A pilot test of the questionnaire was conducted with twenty workers and then administered to 220 DOTD personnel in Winter, 1991.

The results of the workforce questionnaire were the significant concepts, thoughts, phrases, quotations, and tables derived from responses to statements and written responses to open-ended questions of the survey questionnaire. The four categories for organizing these results were the following: (1) applications of communication and information technologies, (2) worker critical skills, (3) survey questions, and (4) workforce characteristics.

Applications of Communication and Information Technologies.

The first question contained fifteen communication and information technologies associated with an advanced technical workplace. Workers were asked to rate the most important based on their perception about the significance of the technologies in their USAAVNC workplace.

Table 1 shows the results of these ratings by administrative support workers (A), project action workers (B), and supervisory personnel (C); total of ratings (T); frequency of selection (F); and rank (R) for the total survey

sample. Total of ratings (T) is the sum of the workforce ratings of significance (A + B + C) assigned by all three categories of personnel using a weighted ranking system, "10" being the highest rating or value of significance possible for a given application by each respondent. Frequency of selection (F) represents the number of respondents who place a rating on this application. Rank (R) is determined by the total of ratings (T), the highest "T" being ranked number "1," the next highest "2," "3," and so forth.

High significance by the sample is placed on word processing, processing information, data manipulation, project management, and problem solving. Relatively low significance is attached to controlling, videoconferencing, forecasting, electronic filing, and budgeting resources. Respondents frequently selected word processing, processing information, scheduling, project management, and data manipulation with a rating of significance.

At the other extreme, controlling, videoconferencing, forecasting, electronic filing, and budgeting were consistently considered low. The most notable exception was that project action workers rated electronic filing high.

The workforce consistently emphasized word processing, processing information, and data manipulation. In addition, administrative support workers placed particular emphasis on scheduling, problem solving, project management, budgeting resources, and monitoring work. Project action workers regarded project management, electronic briefings, problem solving, monitoring work, and desktop publishing as important. Supervisory personnel identified scheduling, problem solving, project management, electronic briefings, and monitoring work as critical.

Table 1

Applications of Communication and Information Technologies

Applications	A	B	C	T	F	R
Word processing	436	960	311	1707	182	1
Process information	362	570	217	1149	160	2
Data manipulation	224	427	209	860	134	3
Project management	218	426	163	807	134	4
Problem solving	230	388	143	761	138	5
Electronic briefings	142	411	175	728	116	6
Scheduling	252	246	149	647	151	7
Monitoring work	164	346	91	601	111	8
Desktop publishing	124	335	96	555	99	9
Goal setting	146	302	75	523	109	10
Electronic mail	94	224	134	452	91	11
Budgeting resources	180	158	107	445	79	12
Electronic filing	124	243	71	438	95	13
Forecasting	66	181	76	323	94	14
Videoconferencing	62	104	53	219	57	15
Controlling	100	84	22	206	62	16
Other:						
Audit Trail Upkeep		6		6	2	
Modem		5		5	1	
Electronic Bulletin Board		4		4	1	
Filled Out Incorrectly	4	1	1	6	1	

Key to Columns:
A--Administrative Support Workers' Ratings
B--Project Action Workers' Ratings
C--Supervisory Personnel Ratings

Key to Columns:
T--Total of Workforce Ratings
F--Frequency of Selection
R--Ranking by Highest "T"

Spaces were included at the end of the list of potential applications to provide an opportunity for respondents to write in potential applications that they felt strongly about for administrative purposes and the development of

classroom instruction and flight training. Four respondents listed audit trail upkeep, modem, and electronic bulletin board.

Worker Critical Skills.

The second question contained twenty-eight worker critical skills associated with communication and information technologies. Workers were asked to rate the most important based on their perception about the significance of these skills for these technologies in their USAAVNC workplace.

Table 2 shows the results of these ratings by administrative support workers (A), project action workers (B), and supervisory personnel (C); total of ratings (T); frequency of selection (F); and rank (R) for the total survey sample. Total of ratings (T) is the sum of the workforce ratings of significance (A + B + C) assigned by all three categories of personnel using a weighted ranking system, "10" being the highest rating or value of significance that can be possible for a given skill by each respondent. Frequency of selection (F) represents the number of respondents who place a rating on this skill. Rank (R) is determined by the total of ratings (T), the highest "T" being ranked number "1," the next highest "2," "3," and so forth.

High rating of significance by the sample is placed on knowledge/ technical, diagnostic skills, basic computer skills, organizing work, and communication skills. Relatively low rating is attached to forecasting, diagnostic skills, electronic filing, influencing skills, and evaluating. Respondents frequently selected knowledge/technical, diagnostic skills, basic computer skills, organizing work, and communication skills with a rating of significance.

Table 2

Worker Critical Skills

Skills	A	B	C	T	F	R
Knowledge/technical	329	511	687	1527	148	1
Diagnostic skills	420	613	312	1345	129	2
Basic computer skills	290	512	156	958	141	3
Organizing work	170	430	85	685	114	4
Communication skills	202	326	123	651	111	5
Ability to learn	180	330	133	643	95	6
Problem solving	144	276	90	510	98	7
Typing/keyboarding	138	221	132	491	71	8
Process information	114	234	109	457	88	9
Retrieve information	144	240	51	435	87	10
Planning	100	216	83	399	87	11
Ideas into practice	130	174	44	348	66	12
Getting along	132	170	40	342	66	13
Electronic briefings	56	218	68	342	58	14
Coping with change	72	158	79	309	58	15
Enter data	82	134	73	289	53	16
Evaluating alternative	66	129	93	288	59	17
Setting priorities	54	143	72	269	69	18
Creativity	90	118	49	257	50	19
Reasoning	52	90	109	251	49	20
Research in networks	98	121	24	243	41	21
Goal setting	72	88	15	175	45	22
Supervisory skills	24	38	84	146	36	23
Monitoring performance	60	65	21	146	25	24
Evaluating	33	63	45	141	28	25
Influencing skills	34	38	66	138	24	26
Electronic filing	52	44	27	123	36	27
Forecasting	30	62	16	108	28	28

Key to Columns:
A--Administrative Support Workers' Ratings
B--Project Action Workers' Ratings
C--Supervisory Personnel Ratings

Key to Columns:
T--Total of Workforce Ratings
F--Frequency of Selection
R--Ranking by Highest "T"

At the other extreme, forecasting, electronic filing, influencing skills, evaluating, and monitoring performance were consistently regarded low. Most notable exception to this was supervisory personnel rated influencing skills high.

Administrative support workers placed particular emphasis on diagnostic skills, knowledge/technical, basic computer skills, communication skills, and ability to learn. Project action workers rated highly diagnostic skills, basic computer skills, knowledge/technical, organizing work, and ability to learn as important. Supervisory personnel stressed knowledge/technical, diagnostic skills, basic computer skills, ability to learn, and typing/keyboarding as critical in the modernized workplace.

Spaces were included at the end of the list of potential critical skills for respondents to write in those skills that they felt strongly concerning administrative purposes and the development of instruction. Two respondents listed electronic bulletin boards and computer education.

Survey Questions.

This survey then asked workforce participants to respond to the open-ended question: "**What bothers you about the applications of communication and information technologies in the USAAVNC workplace?**" Many respondents expressed concern over the lack of policies, programs, and plans of development of organization and human resources for the applications of communication and information technologies at USAAVNC. Respondents consistently felt it was important for them to be kept more up-to-date on what's going on in the area of increased applications of these technologies.

Some respondents wanted a better method of learning what communication and information technologies can do for the worker and the workplace. Many respondents expressed a desire for a practical understanding of what all of these technologies integrated into some form of master architecture of applications is supposed to contribute to getting the job done better than before. The prevailing complaint was that there were no "configuration control or standards" in the applications of systems, software, and procedures, which often results in word processing being done on one system, manipulation of data bases on another, and electronic information processing activities on a third system. No standard word processing program appears to exist.

Frustration within the workforce existed in the inability to network with other USAAVNC activities in lower organizational levels. Adequate funds are often not available to support and maintain critical equipment to do the work.

Respondents were bothered that they were not trained in the use of these technologies, yet were expected to enthusiastically participate in the use of many different advanced technologies. Distribution of these technologies was too limited, and they were not being used to full potential because of skewed allocation of systems, software, procedures, and training.

Not enough training in systems, software, and procedures is available on their applications in the USAAVNC workplace. The budgeting process to acquire the technologies is extremely complex, bureaucratic, and constantly changing, especially in the Automated Data Processing Equipment (ADPE) arena, requiring on-going training for all USAAVNC managers in the acquisition process, not just information management and technology specialists.

Lack of vision from USAAVNC senior leaders and support from middle management limited the ultimate scope of applications of communication and information technologies. These applications established the need for new worker skills and made many skills obsolete.

Some highly educated workers responsible for the development of instruction are at risk of becoming functionally illiterate in their jobs. Many education specialists and training developers complained that they now have to type, format, and transmit documents electronically, which their administrative support workers previously did for them from their hand written drafts.

The increasing use of communication and information technologies causes workers to be less knowledgeable and skillful at work. Willingness and capability to learn/relearn are necessary to keep up with all of the changes in systems, software, and procedures.

Respondents had the following comments concerning what bothers them about the applications of communication and information technologies in the USAAVNC workplace:

1. "Outdated, unreliable manual telephone."
2. "Study performed to ID automation needs to get useful systems."
3. "Once the manufacturer accomplishes the initial train up, nothing."
4. "Do a lot of Admin work that used to go to the secretary."
5. "Not enough information on equipment to talk applications."
6. "Shortage of equipment to establish telecommunications."
7. "Limited resources."
8. "Not enough systems/software and supporting education/training."
9. "Good networking could greatly improve communication and save time and dollars."
10. "Not enough copiers."
11. "Hardware and software is outdated."
12. "No funds to adequately maintain systems critical to do the work needed."

The second open-ended question asked in the survey sample was "**What should be the workforce education and training requirements to close the gap between applications of communication and information technologies and workforce critical skills at USAAVNC?**" Most of the written comments addressed the following workforce education and training issues: lack of programs, relevancy to job tasks, and knowledge of applications of communication and information technologies.

An ongoing training program is required to give workers the basic computer skills--typing/keyboarding, using desktop publishing, networking with distributed systems, and processing information--that are necessary to function effectively in their job. Most respondents stated that they could not respond to this question because they did not know envisioned applications of communication and information technologies. They emphasized that they were not aware of any education and training requirements for technologies.

Respondents emphasized that education and training should be "tailored" to the needs of workers to do the tasks at work. Workforce education and training for technologies should be applicable to the workplace. Briefs, demonstrations, and scheduled formal training should be made available to the workforce. Education and training should involve simple, relevant software; comprehensive instruction; and timely systems availability.

Software tutorials for systems, software, and procedures should support an effective learning experience that allows workers to move through the instructional material and learning objectives with ease while allowing a more structured approach for those who need it. All systems, software, and

procedures should have electronic instruction which allows automatic timing of lessons, on-screen help menus, ways to pause the instruction, and detailed history of learning progress by the worker.

More explanation must be provided to workers about USAAVNC current and future architecture of communication and information technologies. Formal classes in systems, software, and procedures should be available to workers.

An office-by-office survey/analysis should be conducted. More clarity must be provided about the mission of each office and how communication and information technologies can increase productivity and quality of work for that office. A unit-by-unit audit must be conducted to examine work processes and the systems, software, and procedures that are needed in relationship to those processes. Then, more systematic research would be possible to address the issue of workforce education and training requirements for communication and information technologies. A program of education and training could then be made available to the workforce to meet these needs.

Respondents had the following comments concerning what should be the workforce education and training requirements to close the gap between applications of communication and information technologies and workforce critical skills at USAAVNC:

1. "More classes on how systems/software help you do your job."
2. "Establish education and training budget and program separate from other programs and use it."
3. "Do training at the appropriate level for each worker's job."
4. "More assistance in the workplace."
5. "Make training mandatory for the job where these things are."
6. "Requirements should provide basic computer skills to all staff."
7. "Introduction to all available technologies."
8. "Be familiar with WordPerfect, Lotus 123, DBase, Enable."

The third open-ended question asked the survey sample was "**What bothers you about the workforce education and training requirements for communication and information technologies in the USAAVNC workplace?**" Most respondents felt that there were no available education and training requirements and standards for technologies. The predominant comment was that "Most training is on-the-job training given by friends or other office workers with little or no formal literature or program documentation available."

Respondents were bothered that they were expected to use technologies but were not adequately trained to use them in their workplace. Most respondents focused on the fact that there is very little training available. Predominantly, knowledge has to be gained from self-education or from technology literate co-workers. In some cases, training was provided too early and well before the systems, software, and procedures were available for use.

Respondents had the following comments about the workforce education and training requirements for communication and information technologies:

1. "Nonexistent. Lack of formal education and training requirements."
2. "Do not know what is available."
3. "No mandatory training. You get it if available and if you want it."
4. "Not a standard way to do things. Each organization does things differently."
5. "Training is mostly experience or don't make the same mistake twice. On the job training could have precluded the mistake in the first place."
6. "Not timely in a lot of cases. Work load does not ease up to allow on the job training. The crunch-mode is no time to learn how to use systems."
7. "Left up to individual/supervisor to determine, but they lack skills and knowledge to adequately articulate their needs. Therefore, the need for an office-by-office analysis/survey needs to be done."
8. "Not enough dollars to send people to school."
9. "Had to train myself at local colleges at my own expense."
10. "Not enough training in the workplace."
11. "Seems to be no standard word processing program."

12. "Not tailored to individual needs."
13. "Training is often given before systems are available for utilization."

The survey sample was asked: **"Have you ever used communication and information technologies?" "Check any of the following communication and information technologies that you have used."** Of 196 respondents to this question, 153 said yes and continued responding to the questionnaire. Forty-three respondents said no and went directly to Section II of the Workforce Questionnaire to respond questions on workforce characteristics. Two respondents said that they did not know if they have ever used communication and information technologies and they were instructed to respond to Section II.

Table 3 shows the number of respondents who have used communication and information technologies by administrative support workers, project action workers, supervisory personnel, and total respondents for the survey sample. Workforce usage represents the number of respondents who have worked with these technologies.

Of 198 survey respondents to this question, 153 indicated that they used some type of application of communication and information technologies on their jobs. The scope of usage was desktop computer (145), word processing (139), facsimile (126), and data bases (104) for administrative purposes and development of classroom instruction and flight training. Only thirty-eight respondents had used videoconferencing networks. Six respondents felt strongly enough about their use of main frame computer, micro-computer, mini-computer, interactive video device, linear programming, spreadsheets, Defense Data Network, graphics for briefings, interactive video disc, electronic bulletin board, and programming to write them in the questionnaire.

Table 3

Workforce Usage of Communication and Information Technologies

Workforce Usage	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Yes	42	75	36	153
No	20	20	3	43
Do Not Know	0	2	0	2
Desktop Computer	34	77	34	145
Networks	20	30	19	69
Facsimile (Fax)	28	67	31	126
Videoconferences	4	20	14	38
Telecommunications	8	34	17	59
Data bases	24	53	27	104
Desktop Publishing	6	34	18	58
Word processing	28	76	35	139
Other:				
Main Frame Computer		1		1
Micro-Computer		1		1
Mini-Computer		1		1
Interactive Video Device		1		1
Linear Programming			1	1
Spreadsheets		2		2
Defense Data Network		1		1
Graphics For Briefings		1		1
Interactive Video Disc		1		1
Electronic Bulletin Board	1		1	
Programming		1		1

The survey sample was asked: **"When did you start using communication and information technologies: at home? at work?"** Table 4 shows the time frame that respondents started using these technologies by administrative support workers (A), project action workers (B), supervisory personnel (C), and total respondents (T) for the survey sample.

From the results, respondents of the survey sample predominantly started to work with communication and information technologies at work in 1986. Respondents' experience with these technologies resulted more from the workplace than at home.

Table 4

Workforce Years of Experience With Communication and Information Technologies

Workforce Years of Experience	At Home A	B	C	T	At Work A	B	C	T
1975-1980	3	4	1	8	3	2	2	7
1981-1985	4	8	2	14	12	14	15	41
1986	0	3	1	4	5	8	3	16
1987	1	4	1	6	7	21	6	34
1988	0	9	5	14	4	6	5	15
1989	0	2	1	3	5	15	4	24
1990	0	5	2	7	6	9	1	16

Key to Columns:
A--Administrative Support Worker
B--Project Action Worker
C--Supervisory Personnel
T--Total Respondents

The survey sample was asked: "**Was working with communication and information technologies: a positive experience? a negative experience? Describe your experience with communication and information technologies?**" Table 5 shows the workforce rating of positive or negative experience with communication and information technologies by administrative support workers, project action workers, supervisory personnel, and total respondents for the

survey sample. Workforce ratings of experience with communication and information technologies represent the positive or negative experience that respondents had from working with these technologies.

Table 5

Workforce Ratings of Experience With Communication and Information Technologies

Workforce Ratings of Experience	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Positive	36	69	28	133
Negative	3	2	6	11
Do Not Know	1	1	2	4
No Response	2	3	0	5

Of the 148 respondents to the survey question, 133 indicated that working with communication and information technologies was a positive experience. Twelve responded that working with these technologies was a negative experience. Four respondents did not know if they have had a positive or negative experience with technologies. Five workers did not respond to the survey question.

Predominant respondents' comments on "**Describe your experience with communication and information technologies.**" were as follows:

1. "Grasping basic concepts was quick and opened up capabilities."
2. "Forced upon me."
3. "Speeds up getting/receiving information."
4. "Makes a lot of data easy to manage."
5. "Very little assistance in the workplace."
6. "Always have trouble getting the printer to print what is showing on the computer screen."

7. "Found that it increased productivity to a high degree."
8. "Scary at first until I felt comfortable with what I was doing."
9. "Tremendous time saver and product enhancer."
10. "At first negative, then more positive as experience increases."
11. "Permits me to be more efficient and better able to respond to changes."
12. "Frustrating at first due to lack of formal training and good documents."
13. "So far a positive experience--been taken to my limits--still learning."
14. "Everything I learn is from my own experience."
15. "Very good. Job would be almost impossible to do without them."

The survey sample was asked: **"Does your current job performance plan or efficiency report support form direct you to use communication and information technologies on the job?"** Table 6 presents the results of the knowledge of the workforce about any requirement through their current job performance plan or efficiency report support form that directs them to use communication and information technologies on the job. Table 6 also displays the number of administrative support workers, project action workers, supervisory personnel, and total respondents for the survey sample who are aware of any requirement in their personnel management documents.

Table 6

Workforce Requirement to use Communication and Information Technologies

Job Requirement	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Yes	23	47	21	91
No	10	21	15	46
Do Not Know	6	6	0	12
No Response	3	1	0	4

Of 149 respondents to this question, ninety-one indicated that some form of personnel management documents directed them to use communication and information technologies on the job. Primarily, office administration support workers and project action workers who develop classroom instruction and flight training were required to have typing/keyboarding; basic computer skills; storage/retrieval of information; creation and transfer of documents, spreadsheets, files, and graphics; project management; and networking of distributed systems.

Of the 149 workers who responded to this question, forty-six indicated that there was no requirement in the current job performance plan of Army civil service employees or efficiency report support form of military personnel for them to use these technologies. Twelve respondents did not know if there was a requirement. Four workers did not provide a response.

Comments on "**If yes, how will you use these technologies?**" were:

1. "Use the computer and available software to complete my tasks."
2. "Lesson plan development, schedule students/instructors, tracking training of USAAVNC personnel."
3. "Reports, briefings, time management, memorandums."
4. "PC for retrieving/storing data and word processing."
5. "Typing POIs, CMDs, lesson plans, examinations, memorandums and other material as needed."
6. "Job description covers these responsibilities in performance plan."
7. "To process data with greater speed and accuracy."
8. "For searching data bases, manipulation and retrieval of information. Storing of information."
9. "Required to work with remote and local data bases on daily basis."
10. "I will use these technologies to research information for patrons."
11. "On-line cataloging--flag documents."
12. "Spreadsheets, word processing, data base, linear programming, statistics, and multi-attribute decision-making."
13. "I have to use data, i.e., comparison of AF, Navy, Marine funding, etc., occupational surveys and other analysis of data."
14. "Data analysis, work scheduling, word processing, briefings, electronic mail."

15. "To develop performance plans, tracking items of performance, i.e., classes taught, materials developed, evaluation conducted."
16. "Desktop computer used to develop training programs, training aids, etc. Networking with other systems sometimes required."
17. "Word processing, telecommunications, desktop publishing, Fax, electronic presentations/briefings."
18. "Create documents, track projects, store data, transfer information, scheduling, milestone charting."

The survey sample was asked: **"Was successful completion of any education and training requirements a condition for you before working with communication and information technologies?"** Table 7 presents the results of the knowledge of the workforce of any requirement of successful completion of education and training by workers as a condition for working with communication and information technologies. Table 7 also displays the number of administrative support workers, project action workers, supervisory personnel, and total respondents for the survey sample who had a requirement.

Table 7

Requirement for Education and Training

Requirement	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Yes	12	7	4	23
No	26	54	29	109
Do Not Know	4	11	3	18
No Response	0	3	0	3

Of 150 respondents who answered the question, twenty-three respondents indicated that successful completion of education and training requirements was a condition for working with communication and information technologies. Respondents who worked in the USAAVNC technical library had

to complete a library science curriculum with courses in information science and some work experience in the field. They were also expected to successfully complete "self-taught" courses using the operator's manual of the system on word processing, spreadsheets, and networks as the equipment was installed.

Of 150 respondents to this question, 109 indicated that there was no condition of successful completion of education and training requirements for working with these technologies. These respondents focused on the fact that they were given the systems, software, and procedures and expected to operate them without any formal training. Some courses on word processing, spreadsheets, and networks were often provided, but successful course completion was never a condition before working with these technologies. Eighteen respondents did not know if there was any condition of successful completion of education and training requirements for technologies. Three workers did not respond.

The survey sample was asked: "**How would you rate the adequacy of your education and training before working with communication and information technologies?**" Table 8 presents the results of the ratings of adequacy of education and training for technologies by administrative support workers, project action workers, supervisory personnel, and total respondents for the survey sample. Ratings of adequacy represent the value that respondents placed on how sufficient the education and training was that they received before being directed by supervisors to work with these technologies.

Of 140 respondents to this question, sixty-one indicated that the adequacy of education and training was poor for communication and

information technologies. Most respondents focused on the fact that education and training were nonexistent, and therefore, inadequate. Respondents who did receive some training predominantly emphasized that it was not adequate for their needs in the workplace. Courses primarily addressed only a basic level of introduction on systems, software, and procedures. Most training involved basic typing/keyboarding with a simple word processing program.

Table 8

Adequacy of Education and Training

Adequacy	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Poor	10	30	21	61
Fair	5	10	5	20
Average	5	6	2	13
Good	9	21	4	34
Excellent	8	3	1	12
No Response	5	5	3	13

Predominant respondents' comments about adequacy of education and training for communication and information technologies were as follows:

1. "Non existent. Education and training for technologies is not available."
2. "We were given the equipment and expected to operate it without any formal training."
3. "Had to train myself at local colleges."
4. "Difficult to get into the needed courses."
5. "No standards defined."
6. "Lack of dollars and supervisor support to release for training."
7. "Did not receive any. My experience has been a result of self-education."
8. "Very limited instruction on outdated systems/software."
9. "Once the vendor leaves after initial training, no more formal training."
10. "Lack of knowledge of using systems was hampering my tasks."

The survey sample was asked: **"How would you rate the relevancy of your education and training before working with communication and information technologies?"** Table 9 presents the results of the ratings of relevancy of education and training by administrative support, project action, supervisory personnel, and total respondents for the survey sample. Ratings of relevancy represent the value that the respondents placed on how applicable the education and training for technologies were to what they do in the workplace.

Table 9

Relevancy of Education and Training

Relevancy	Administrative Support	Project Action	Supervisory Personnel	Total Respondents
Poor	16	27	21	64
Fair	11	19	9	39
Average	8	11	5	24
Good	4	14	1	19
Excellent	1	1	0	2
No Response	2	3	0	5

Of 148 respondents to this question, sixty-four indicated that the relevancy of education and training was poor for communication and information technologies. Most respondents focused on the lack of on-the-job training that makes these systems more useful at work. Respondents who did receive some training predominantly emphasized that it was not relevant for their needs in the workplace. Training for workers primarily addressed start-up, operation, and shutdown of systems and software at a very basic level of introduction.

Predominant respondents' comments about relevancy of education and training for communication and information technologies were as follows:

1. "None of it dealt with comm/info tech."
2. "Not enough classes on how systems/software help you do your job."
3. "Knew what systems were supposed to do but had no technical skills to do it."
4. "I had very little training. What I had was on an inappropriate computer."
5. "Not tailored to individual needs."
6. "Courses specifically address software/system I was using at the time, but they were a basic level."
7. "Training conducted only at very low entry level."
8. "I had no training."
9. "I received a course in DBase III 2 years before we purchased any DBase software."
10. "Education involved more theory than practice."
11. "Often not informative enough."
12. "No relevancy."
13. "None received. Self-taught."
14. "Only typing skills."
15. "Training is often given before systems are available for use."

Workforce Characteristics.

The second section of the questionnaire consisted of five questions concerning workforce characteristics. Table 10 presents the characteristics by administrative support workers (62), project action workers (93), supervisory personnel (32), and total respondents (192). Respondents were predominantly male (133), white not of Hispanic origin (131), over 36 years of age (152), and over one half (113) with at least a college degree. They were approximately halved between military personnel (96) and Army civil service employees (91).

Table 10

Workforce Characteristics

Characteristics	A	B	C	T
Sex: Male	22	84	27	133
Female	36	11	12	59
No Response	4	2	0	6
Age: 21-27	2	7	2	11
28-35	5	20	10	35
36-42	10	11	10	31
43-55	22	27	14	63
56+	4	4	3	11
Ethnicity:				
Black of Non-Hispanic origin	10	8	5	23
American/Alaskan Indian	0	2	0	2
White of Hispanic origin	6	2	0	8
Asian/Pacific Islander	0	2	2	4
Black of Hispanic origin	0	0	0	0
White not of Hispanic origin	30	69	32	131
Other	1	3	0	4
Workforce status:				
Military	24	60	12	96
Army civil service employee	38	33	20	91
Highest formal civilian education degree completed:				
Less than high school	0	0	0	0
High school diploma	28	36	6	70
GED	0	2	2	4
Associate degree	6	6	0	12
Bachelor	10	26	14	50
Master	10	23	14	47
Doctorate	0	2	2	4

Key to Columns:
A--Administrative Support Worker
B--Project Action Worker

Key to Columns:
C--Supervisory Personnel
T--Total Respondents (A+B+C)

Chapter 5

INTERPRETATIONS, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this Major Applied Research Project (MARP) was to identify the workforce education and training requirements for communication and information technologies at the United States Army Aviation Center (USAAVNC). Key elements were developed of a USAAVNC human resources development plan for these technologies which are used for administrative purposes and the development of classroom instruction and flight training.

There were four major research questions: (1) what are the communication and information technologies that will be used for administrative purposes and for the development of instruction over the next several years? (2) what are the worker critical skills that will be necessary to use the next wave of these technologies? (3) what will be the educational and training requirements of the workforce? and (4) what are the key elements of a USAAVNC human resources development plan? These research questions were answered with both qualitative and quantitative data.

Qualitative data were collected from interviews of key personnel, discussions by a group of experts, and survey questions. Quantitative data were collected in a survey sample of 220 workers from the Directorate of Training and Doctrine (DOTD), USAAVNC. Discussion of results was written with four categories for organizing interpretations, conclusions, and

recommendations concerning communication and information technologies: (1) mission, policies, and plans; (2) applications; (3) worker critical skills; and (4) workforce education and training requirements.

Interpretations

Interpretations resulted from the analysis of qualitative and quantitative data. Understanding the career education and technical training mission of USAAVNC in relation to the modernization issues of the development of organization and human resources allowed comprehensive and systematic analysis of data. These modernization issues included institutional mission definition, total quality management, strategic planning, demographics, workers' skills, technology literacy, applications of technologies, and workforce education and training for technologies in today's advanced technical society. The interpretations which follow are organized in three sections: mission, policies and plans; applications; worker critical skills; and workforce education and training for communication and information technologies.

Mission, Policies, and Plans.

The discussion is organized in three sections: mission, policies, and plans.

Mission. All effective institutions have a clear mission, policies, plan or set of plans to achieve that mission. The USAAVNC mission is to provide career education and technical training to all aviation personnel. This mission will essentially remain unchanged even though the emphasis may shift based on changing global forces and national security and interests.

All effective institutions continuously analyze mission and essential purposes, the work to be accomplished, the education and employment of people resources, the use of know-how and technology, and plant or physical infrastructure. The Army is modernizing through communication and information technologies that has been driven by an urgent need to enhance productivity and improve quality of work during a period of reduced resources. To accomplish the USAAVNC mission, increased use is being made of these technologies for administrative purposes and for the development, delivery, and support of classroom instruction and flight training.

Policies. First, no clear policies exist for the systematic and planned implementation of state-of-the-art-technologies. That is to say, there is no policy to serve to bridge from mission to guide the creation of integrated work stations throughout USAAVNC. Second, no clear policies are available for the planned development of organization and human resources within USAAVNC.

Policy making and decisions on communication and information technologies in the Army have been made in the top-down manner of a traditional bureaucracy. The Department of the Army initiatives for modernization have become so overriding that these technologies are being forced on organizations before all segments of them are fully operational, integrated, and checked out without the workforce's being adequately prepared. The interest and involvement of the USAAVNC senior leaders dictated the immediate use of these technologies to meet the Department of the Army initiatives for modernization and rigid schedules for acquisition and implementation of technologies.

Plans. Effective institutions have a plan or set of plans to guide its systematic development. The plan should be based on a collaborated process and the result of extensive discussion about the mission of USAAVNC in the "Army of the future" and institutional policies of organization development (OD) and human resources development (HRD). No clear plans exist.

Official plans included The Army Modernization Memorandum (AMM), USATRADOC Long Range Plan (LRP), and Directorate of Information Management (DOIM) Information Management Plan for the implementation of communication and information technologies. These plans primarily addressed the elements of acquisition and distribution, but lacked adequate scope to address fully the applications, critical skills, and workforce education and training for communication and information technologies in the modernization of the USAAVNC workplace.

Other plans that were evaluated included two personnel management documents--job performance plan and Individual Development Plan (IDP). Some job performance plans of workers directed them to use communication and information technologies and outlined specific duties and performance standards for using these technologies. The IDP could provide an official method of planning for the workers to develop the specific knowledge and skills to be technology literate, to work effectively, and to contribute to the mission.

Personnel management documents that control the annual performance appraisal and career progression of workers have not been adapted to include the education and training requirements for communication and information technologies. Job performance requirements must be linked to each worker's

position description and also be strong enough to trigger other documents and plans to make money and opportunity available for the worker to receive the education and training for these technologies.

Current policies and plans concerning communication and information technologies were consistently viewed as inadequate and irrelevant during interviews, discussions, and survey. Many respondents invariably emphasized the need for a unit-by-unit audit of each organization and supporting policies and plans that are based on its mission to determine applications for these technologies that are actually required.

Applications of Communication and Information Technologies.

The discussion of applications of communication and information technologies is organized in four sections: organizational environment, integrated work stations, and implementation problems.

Organizational Environment. Applications of communication and information technologies have shifted traditional work processes that are based mainly on paper handling and rigid bureaucracy at USAAVNC to a new advanced technical workplace of integrated work stations and empowerment of workers. Workers in USAAVNC organizations are now electronically linked. This procedure has effectively reduced the traditional boundaries, rigid barriers, and reporting channels characteristic of a bureaucracy. Total quality management, strategic planning, technology literacy, and empowerment of workers within a more open organizational environment are driving decentralization of the authority and responsibility of applications to support mission.

The results of key personnel interviews, discussions by a group of experts, and survey ratings/responses placed special emphasis on applications of technologies such as processing information, desktop publishing, project management, and supervision. This study outcome was consistent with the organizational environment and activities associated with administrative purposes and development of classroom instruction and flight training. Results supported the intent of the USATRADOC LRP to establish integrated desktop publishing throughout the sixteen USATRADOC installations, nationwide.

Integrated Work Stations. The implementation of integrated work stations can support the mission of the organization by automating basic organizational processes of administrative support, project action, and supervision while providing information for better decision-making. The essential components of an integrated work station are the micro-computer, software features, a high quality printer, a digital color copier, a facsimile (Fax), data base(s), a modern phone system, and interactive network(s) of distributed systems. Good integrated work stations are readily available for purchase from industry at a reasonable cost and could provide more capability to USAAVNC workplace than exists in the traditional "paper and file cabinet" office.

Implementation Problems. The results of the key personnel interviews, discussions by a group of experts, and responses to survey questions confirmed that workers often felt forced to use communication and information technologies predominantly because external organizations to USAAVNC demanded their use during coordination and workers had not received adequate education and training to use them. The interest and involvement of the

USAAVNC senior leaders dictated the immediate use of these technologies to meet the Department of the Army initiatives for modernization and the rigid schedules for acquisition and implementation of technologies.

The applications of communication and information technologies have been fashioned to the dimensions of the traditional workplace and standard organizational processes associated with a hierarchical bureaucracy. The lack of a centralized plan and single responsible source of information has resulted in weak configuration control and standards, uneven allocation, and less than optimal operational rates for systems, software, and procedures to support organizational processes. USAAVNC bureaucratic procedures and limited resources have also made operation and maintenance of critical systems and software more frustrating.

Worker Critical Skills.

The discussion of worker critical skills is organized in four sections: significance, cognitive, basic computer skills, and categories of skills.

Significance. In the past, many workers were able to develop the required skills necessary to use the early wave of communication and information technologies to enhance utilization of technologies, organizational processes, productivity, and quality of work. However, the latest state-of-the-art communication and information technologies are more complex and have tremendous implications to the skill levels of the USAAVNC workforce.

Workers often failed to perceive the value of learning new communication and information technologies for their jobs. A more comprehensive understanding of opportunities and threats associated with the

challenge of advanced technologies in the USAAVNC workplace is necessary to empower workers to contribute to the mission and personally benefit from the applications of these technologies. Empowerment of workers is required to give them the knowledge, skills, and attitudes necessary to use the advanced technologies in the modernized workplace.

Cognitive. Many worker critical skills have been identified that are necessary to use the latest state-of-the-art communication and information technologies for administrative purposes and the development of classroom instruction and flight training. Foremost, intellectual skills are important for understanding information, recognizing concepts, synthesizing implications, organizing efforts, and solving problems. Learning to learn requires skills in problem analysis, problem solving, as well as building learning networks.

The USAAVNC workers using communication and information technologies must have skills that are necessary to read and comprehend technical documents for systems, software, and procedures, especially to diagnose simple problems. Workers need to be able to grasp basic concepts of systems, software, and procedures and apply them to workplace tasks and organizational processes to accomplish the mission.

Basic Computer Skills. The results of key personnel interviews, discussions by a group of experts, and survey ratings/responses placed special emphasis on basic computer skills that are associated with an integrated work station. These skills include typing/keyboarding, desktop publishing, networking distributed systems, and processing information--retrieve, store, manipulate, control, and circulate.

Categories of Skills. The USAAVNC workers who are using communication and information technologies can be grouped into three categories--administrative support, project action, and supervisory. Critical skills for administrative support workers include the willingness/ability to learn; information synthesis; basic computer skills; diagnostic skills; communication skills; and knowledge of systems, software, and procedures.

Project action workers need the same critical skills as administrative support personnel. In addition, they require research techniques, analytical methods, problem solving, forecasting, electronic briefings, organizing/ monitoring work, planning, data manipulation, budgeting resources, and videoconferencing in networks. Supervisory personnel need the same critical skills as administrative support personnel, in addition to problem solving, forecasting, electronic briefings, organizing/monitoring work, planning, budgeting resources, and videoconferencing in networks.

Workforce Education and Training Requirements.

The discussion of workforce education and training requirements that follows is organized in three sections: significance, definition, and key elements of a human resources development plan.

Significance. Prevailing literature and studies revealed that many organizations have failed to realize benefits from the applications of communication and information technologies due to inadequate or irrelevant workforce education and training for these technologies. Workforce education and training for technologies are major issues for the 1990's because of

(1) the growing gap between technologies and worker skill levels, (2) the relatively more costly upgrades of systems, software, and procedures as worker skill levels lag behind, and (3) more dollars spent on training than technologies.

Workers need education and training for communication and information technologies to accomplish (1) information flow and the development, coordination, and distribution of documentation; (2) planning through organizing, retrieving, reviewing, and determining requirements; (3) controlling effort; (4) maintaining currency on requirements, policies, and procedures; and (5) responding to inquiries, requests for information, and staffing actions from USAAVNC and its higher headquarters, USATRADOC. Effective use of these technologies must have well-thought out workers' critical skills describing a change in value/attitude or knowledge/skill level that the workers will have after receiving the education and training.

Definition. Within the context of Army education and training, it is important to understand these terms. Education is recognized as the process of integration of higher-order, cognitive, affective, and psychomotor competencies. Training is the process of workers learning technical skills for systems, software, or procedures.

Key Elements of a Human Resources Development Plan. The workforce education and training requirements for communication and information technologies can be grouped into four essential areas of consideration: (1) strategy, (2) scope, (3) standards, and (4) primary critical tasks. These areas represent the basis for the key elements of a human resources development plan which is located in Appendix G.

The first essential area of significance is the strategy concerning workforce education and training for communication and information technologies. A comprehensive strategy is required for the successful preparation of workers to accept, use, and integrate these technologies to accomplish the USAAVNC mission. It involves centralized source of information, involvement of workers, configuration of technologies, mandatory education and training, adjustment of the USAAVNC human resources development goals, linkage of knowledge and proficiency to annual worker appraisal, equal opportunity, and creation of a learning community.

The second essential area of significance is the scope of workforce education and training for communication and information technologies. The scope is essential to establish the influence of the education and training. It involves desired learning outcome(s), required skills, job analysis, individual assistance, alternative training processes, education for workers in the capabilities of technologies, and designation of trainers and user groups.

The third essential area of significance is the standards of workforce education and training for communication and information technologies. Standards are required to establish the principles of education and training. They involve adjustment of the instructional design, equal opportunity, training elements, learning objectives, standardized criteria, detailed plans, building block approach, complete mastery of skills, a comfortable learning atmosphere, and synchronization of education and training for technologies to the arrival of systems, software, and procedures in the workplace.

The last essential area of significance is the primary critical tasks which require education and training in the communication and information technologies that will be used for administrative purposes and the development of aviation instruction. These tasks represent the main activities associated with administrative matters and the development of classroom instruction and flight training which require the relevant applications, critical skills, and workforce education and training for these technologies. These tasks include typing/keyboarding, using software, processing information, preparing documents, diagnostic, monitoring progress, networking with distributed systems, research techniques, and understanding technical documents.

Conclusions

Conclusions are organized in three sections: mission, policies, and plans; applications; worker critical skills; as well as workforce education and training for communication and information technologies.

Mission, Policies, and Plans.

The conclusions which follow are organized in three sections: mission, policies, and plans.

Mission. The USAAVNC mission will continue to be to provide career education and technical training to all aviation personnel. An urgent need exists at USAAVNC to use communication and information technologies to accomplish its mission, enhance productivity, and improve the quality of work during a period of reduced resources. USAAVNC will make increased use of these

technologies for administrative purposes and for the development, delivery, and support of classroom instruction and flight training.

More clarity must be provided about the purpose of each organization and unit and how communication and information technologies can increase productivity and reduce the costs of operation. Senior leaders and key staff personnel at USAAVNC will have to continuously analyze mission and essential purposes, the work to be accomplished, the education and employment of human resources, the use of know-how and technology, and plant or physical infrastructure.

Policies. No clear policies exist for the systematic and planned implementation of integrated work stations or development of organization and human resources for communication and information technologies. It is important to recognize that the United States Army, specifically USAAVNC, is a rather traditional bureaucratic organization. USAAVNC is characterized by an authoritative atmosphere, top-down guidance, and rigid compartmented organizations to accomplish its mission of career education and technical training for aviation personnel. Prevailing complaints by the USAAVNC workforce concerning the policies for implementation of technologies include not timely, uneven allocation, nonstandard, and inadequate number and type of systems, software, and procedures.

The systems, software, procedures, and training cannot be allowed to just arrive in the USAAVNC workplace in accordance with rigid material acquisition schedules of the Department of the Army staff. A unit-by-unit audit of USAAVNC must be conducted to examine organizational processes based on

its mission in relation to systems, software, and procedures being implemented to comply with the Department of the Army initiatives for modernization. Special services of experts in academia, industry, and government can be made available or contracted with government funds to assist in staff planning, policy making, and on-site training of communication and information technologies.

Ultimately, workers must be allowed to have more influence in the development of planning, policy, and decisions concerning selection, implementation, and integration of technologies in their areas of responsibility. This involvement would contribute to less workforce anxiety, more appreciation of technologies, and more interest in workforce education and training.

Plans. It can be concluded that a clear plan or set of plans must be developed if to achieve maximum effectiveness of communication and information technologies. Workers need to be made aware of the unique role that these technologies can play in achieving that mission. This will involve a series of documents from the Department of Defense staff to the unit level based on a collaborated process and the result of extensive discussion about the mission of USAAVNC in the "Army of the future" and policies of organization development (OD) and human resources development (HRD).

No clear plans exist. Official plans such as The Army Modernization Memorandum (AMM), USATRADOC Long Range Plan (LRP), and Directorate of Information Management (DOIM) Information Management Plan primarily addressed the elements of acquisition and distribution, but lacked adequate scope to address fully the applications, critical skills, and workforce education and training for communication and information technologies in the

modernization of the USAAVNC workplace. These plans were consistently denounced as inadequate and irrelevant during interviews, discussions, and survey. Many respondents invariably emphasized the need for a unit-by-unit audit of each organization and supporting policies and plans based on its mission to determine applications, critical skills, and workforce education and training for communication and information technologies which are required.

Of these documents evaluated, only the USATRADOC LRP contained a broad statement for the commanders of the sixteen USATRADOC institutions to develop and incorporate a complete training strategy for their workforce as part of a total Army objective to educate and train its workforce for these technologies. Two personnel management documents--job performance plan and Individual development Plan (IDP)--could provide an official method of efficient planning for the workers to develop the specific knowledge, skills, and attitudes to be technology literate, function effectively at their jobs, and contribute to successful accomplishment of USAAVNC mission.

Applications of Communication and Information Technologies.

The Army workplaces in its schools are changing due to the state-of-the-art communication and information technologies. First, software applications are increasing in number and improving in quality. Second, costs for systems of advanced technology are more reasonable. Third, Army senior leaders are accepting more quickly the current wave of technologies and it is anticipated that this trend will continue throughout the 1990's.

A primary USAAVNC imperative has become the applications of communication and information technologies as one of the initiatives by the Department of the Army to reduce significantly the costs of career education and technical training of aviation personnel. Despite the ongoing forced issue of these technologies into the workplace, application, integration, and utilization of communication and information technologies at USAAVNC is in an embryonic stage of practical application.

Key applications of communication and information technologies include administrative purposes and the development of classroom instruction and flight training. An integrated work station represents the substance of these applications for processing information, desktop publishing, project management, and supervision. The essential components of an integrated work station are the micro-computer, software features, a high quality printer, a copier, a facsimile (Fax), data base(s), a modern phone system, and interactive network(s) of distributed systems.

Applications of communication and information technologies have allowed more decentralized control to take optimal advantage of more user-friendly and affordable technologies. Organizational development now provides for more rapid communication and less rigid organizational structure.

Organizational development involves learning, but it is more concerned with long-ranged planned changes in technologies, management, and culture which impact the organization. Human resources development is based on learning theory and is focused on worker competencies and methods for disseminating the learning throughout the organization. As the applications of

communication and information technologies mature to create the modernized workplace, the challenge of human resources development becomes more critical to create immediate organizational and individual behavior changes for increased productivity and reduced costs of operation.

Worker Critical Skills.

Workers must have certain skills that are critical in the workplace of communication and information technologies. Failure of workers to learn the critical skills could lead to a functionally illiterate person unable to cope with the applications of these technologies, to achieve desired appraisal of annual performance, and to realize expected career progression. Specific worker critical skills include willingness/ability to learn; synthesizing information; basic computer skills; diagnostic skills; communication skills; and knowledge of systems, software, and procedures.

Worker skills must also be tailored to the specific work processes associated with the workplaces of administrative support, supervisory, and project action personnel. A program of specific education and training for each worker's requirements for technologies is the solution for the worker to contribute to the successful accomplishment of the organization's mission.

Workforce Education and Training Requirements.

A continuing program of education and training for communication and information technologies is required to empower workers with the critical skills which are so necessary for them to be technology literate and to function effectively in their jobs. First, human resources development at USAAVNC

needs to be adjusted using the key elements of a human resources development plan. (Key elements are discussed in Appendix G.)

Second, workers need to be made aware of the envisioned hardware architecture and contributions of these technologies. Workers must attain more knowledge of systems, software, procedures, and training.

Third, personnel management documents that control the annual performance appraisal and career progression of workers should be updated to include the education and training requirements for communication and information technologies. These requirements must be tied to each worker's position description and also be strong enough to trigger other documents and plans to make money and opportunity available for the worker to receive the education and training for these technologies.

Finally, a learning atmosphere in the workplace should be developed and maintained where opportunities, time, and resources exist for workers to acquire the job-related critical skills that are necessary for them to be technology literate.

Recommendations

Recommendations are organized in three sections: mission, policies, and plans; applications; worker critical skills; and workforce education and training for communication and information technologies.

Mission, Policies, and Plans.

Mission. The mission of the USAAVNC must be more clearly understood and must be the conceptual framework for policy development and the creation

and continuous refinement of plans for the development of organization and human resources. More clarity should be provided about the purpose of each organization and how communication and information technologies can increase productivity and reduce the costs of operation.

Policies. Policies must be created for the systematic and planned implementation of the state-of-the-art technologies and for the development of organization and human resources. It is recommended to the extent possible that workers in various levels of the organization participate early on in the planning for, as well as the introduction of communication and information technologies into the workplace. Workers should be allowed to have more influence in development of policy and decision-making in the areas that affect their workplace.

The survey questionnaire should be incorporated into existing USAAVNC standard operating procedures and made an integral part of a complete USAAVNC review process to determine workforce education and training requirements for technologies. The questionnaire should also be included in the screening process of personnel management as a continual or periodic survey of workforce education and training requirements for communication and information technologies under the context of changing demographics, a diversified workforce, dynamic advanced technology environment, and significant emerging societal factors.

A special task force should be established which is comprised of key personnel--administrative support, supervisory, and project action--to help disseminate the substance of this analysis.

Special services of experts in academia, industry, and government should be made available to contribute to staff planning, decision-making, and on-site training in communication and information technologies. Visits by supporting contractors should be scheduled as required for training refreshers.

Distributed seminars should be conducted on this study using videoconferencing networks at the sixteen USATRADOC installations nationwide for policy planners and decision-makers to interact and discuss human resources developmental issues such as education and training for technologies, desired worker critical skills, and program planning.

Substantive information from this study should be disseminated to USAAVNC leaders, USATRADOC Headquarters staff, and selective Army organizations to provide the emphasis for better policy and program planning in the development of organization and human resources.

The study should be made available to the Army research community to support more educational research and statistical studies. The results and interpretations of these efforts would build the analytical underpinnings of a substantial foundation to influence plans and budgets. A solid base is required to motivate the human resources development in the modernized workplace of the Army school system. The future scenario will be more, not fewer, attempts to identify workforce education and training requirements for communication and information technologies.

Plans. A plan or set of plans should be produced by key personnel and experts who are knowledgeable of requirements for technologies upon the

completion of a unit-by-unit assessment and include(s) synchronized components of organization and human resources development.

Personnel management documents, which control the annual performance appraisal and career progression of both military personnel and Army civil service employees, should be updated to include the education and training requirements for communication and information technologies. These requirements must be tied to each worker's position description and also be strong enough to trigger other planning and funding documents to make money and opportunity available for the worker to receive the education and training.

Significant study concepts and implications must be published as a USAAVNC white paper to create a basis for near-term managerial interventions, a strategic plan, and a unified vision of the advanced technology workplace. Better awareness of all aspects of modernization efforts supports a smoother transformational atmosphere, increased productivity, and reduced costs of operation in the USAAVNC workplace. The failure of senior leaders to fully understand and accommodate the workforce education and training requirements and, ultimately, to orchestrate effective managerial intervention policies can only result in the modernization issues of the Department of the Army not being realized to their full potential.

Applications of Communication and Information Technologies.

The key applications of communication and information technologies should be recognized as crucial contributions to the successful accomplishment of the USAAVNC mission. Processing information, desktop publishing, project

management, and supervision represent the nature of these applications. The micro-computer, software features, a high quality printer, a digital color copier, a facsimile (Fax), data base(s), a modern phone system, and interactive network(s) of distributed systems should be considered as the essential components of an integrated work station to support the mission.

Workers should be made aware of the envisioned architecture and contributions of communication and information technologies. They must attain more knowledge of systems, software, and procedures which are related to their areas of responsibility.

Applicable portions of this study should be made available to the workforce as evidence that the implementation of communication and information technologies is an opportunity and not a threat to the workplace, workforce expectations, as well as organizational and institutional goals. More preparation of the worker is required to use these technologies effectively in the workplace.

Letters or flyers should be published for the workforce that provides updated information on systems, software, procedures, and training.

Worker Critical Skills.

Worker critical skills should be recognized as essential for workers so as to enable them to contribute to the USAAVNC mission and to optimize applications of communication and information technologies. These skills include willingness/ability to learn; understanding information; recognizing concepts; synthesizing implications; organizing efforts; solving problems; basic computer skills; and knowledge of systems, software, and procedures. Worker skills must also be tailored to the specific work processes associated

with the workplaces of administrative support, supervisory, and project action personnel--education specialists and training developers.

Workforce Education and Training Requirements.

Workforce education and training for communication and information technologies should be designed to the worker critical skills and applications of technologies. Education and training in technologies should be conducted as soon as a worker is assigned the duties and responsibilities of the job. Workers should be given equal opportunities, resources, and time to learn the critical skills that would contribute to their being a technology literate worker, one who is able to cope with the applications of these technologies, achieve desired appraisal of annual performance, and realize expected career progression.

An ongoing program of education and training for these technologies should be established to provide workers with critical skills. Specifically, the key elements of a human resources development plan must include (1) strategy, (2) scope, (3) standards, and (4) primary critical tasks. (These areas are discussed in Appendix G.) First, a comprehensive strategy is recommended for the successful preparation of workers to accept, use, and integrate these technologies to accomplish the USAAVNC mission. Second, a defined scope is recommended to encourage acceptance of technologies, facilitate learning, and meet job requirements. Third, standards are recommended to establish the principles of education and training. Lastly, primary critical tasks are recommended to empower the worker to contribute to the successful accomplishment of the mission.

Education and training should be provided to education specialists and training developers in the unique activities associated with the development of classroom instruction and flight training using communication and information technologies. These activities include processing/retrieving information from networks/data bases, use of integrated work stations, electronic briefings/ presentations, desktop publishing, and management.

Basic computer skills should be taught to all workers. Advanced skills training should be conducted on an individual basis when and by type needed.

An on-site training program should be implemented for communication and information technologies, which is composed of general modules and tailored modules in conjunction with on-the-job training. The first module is used by all workers using these technologies and covers general orientation and introduction to the modules that will follow. The next modules are tailored for the purposes and needs of the different groups of workers at USAAVNC. In between the training periods, there are on-the-job training times where the workers combine their work and new knowledge and skills from the modules. The workers are also networking with each other. The modules are the foundation of the education and training. The networking and on-the-job training intervals are used to sustain the learning from these modules.

User groups should be formed in workplaces to share common work problems concerning the applications of communication and information technologies. Trainers who are subject matter experts in the systems, software, and procedures of communication and information technologies

should be identified in the workplace to help co-workers when problems are encountered.

Recapitulation

The nations of the world including all their establishments are undergoing fundamental restructuring. The United States military has two primary missions: (1) preserve peace and (2) wage war. Rapid advances in research and development, particularly in communication and information technologies, will continue to have profound impact on both missions.

The United States has a military infrastructure unparalleled in the history of the world. Because of its high technology character, the military will continue to experience unprecedented fundamental restructuring. Selected military institutions with an intensive concentration of state-of-the-art technology face the unique challenge to anticipate the force of advances in science and technology and interpret the impact on workplaces and workforce education and training requirements.

This Major Applied Research Project identified the workforce education and training requirements for communication and information technologies at USAAVNC and specified key elements of a human resources development plan. The project dealt with specifications for the development of a learning community of high performance learners and workers. Military institutions must implement a human resources development program if they hope to achieve their missions.

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APPENDIX A

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND (USATRADOC) MISSION

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND (USATRADOC) MISSION

The United States Army Training and Doctrine Command (USATRADOC) with headquarters at Fort Monroe, Virginia, was formed in July 1973 to develop the doctrine, weapons systems, support equipment, organization, and career education and technical training essential to ensure that soldiers are ready to keep the peace and fight and win future conflicts. There are over 90,000 military personnel and Army civil service personnel employed at three major subordinate commands, twenty-seven service schools, sixteen institutions, eight initial entry training centers, and three combined arms integrating centers.

USATRADOC receives policy direction from the Department of the Army staff in Washington, District of Columbia. USATRADOC then supports operational forces which are deployed worldwide by using the policy direction to maintain the force in the highest state of war-fighting preparedness possible with the resources provided in support of United States national interests and security.

USATRADOC strengthens the Army for war by developing war-fighting doctrine, supervising the combat development process, and conducting education and training. The most vital portion of its mission is the career education and technical training of Army personnel. The focus of its education and training activities is in the schools, training centers, and institutions where soldiers are trained to fight.

The USATRADOC commander has identified six areas that will be critical to USATRADOC in meeting the challenges of the 1990's. To control its destiny, USATRADOC must synchronize efforts, adjust organizations, and invigorate the Army workforce. While manpower and funding continue to decrease, USATRADOC education and training requirements continue to increase. For the 1990's, USATRADOC must do the following:

1. Accomplish substantial work to produce Army-unique, war-fighting doctrine; joint service and combined arms doctrine; and "how to" manuals on tactics, techniques, and procedures.

2. Accommodate in force design policy significant factors such as new equipment, command and control, alternative (cross-branch) force design analyses, and the design and testing of new concepts and organizations.

3. Determine equipment requirements in support of integration and prioritization of war-fighting capabilities that will be influenced by technology opportunities, automation, modernization plan rationality, and costing of operations and support.

4. Establish a total Army leader development process that emphasizes education, training, assignments, experiences, assessments, and feedback.

5. Maintain war-fighting preparedness as the Army's cornerstone for combat readiness with a focus for tough, realistic training oriented toward challenging but achievable performance standards.

6. Provide effective mission support across USATRADOC in automation support, mobilization planning, safety concerns, and threat analyses.

APPENDIX B

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND (USATRADOC) ORGANIZATION

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

(USATRADOC) ORGANIZATION

USATRADOC is organized into the following principal subdivisions:

1. COMMAND GROUP. The Command Group comprises Commanding General, Deputy Commanding General, Chief of Staff, and Garrison Commander.

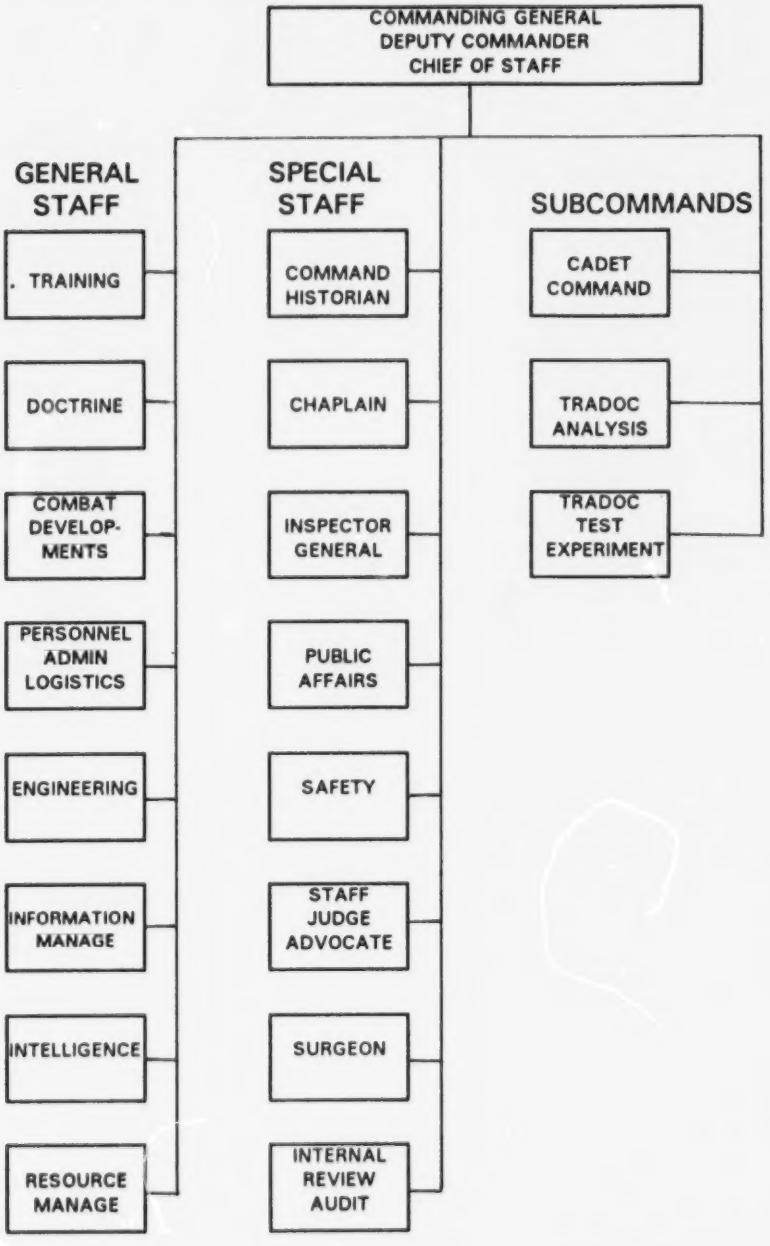
2. GENERAL STAFF. The General Staff comprises the offices of the Deputy Chief of Staff for Combat Developments, Doctrine, Training, Engineering, Information Management, Intelligence, and Resource Management.

3. SPECIAL STAFF. The Special staff comprises the offices of Command Historian, Chaplain, Inspector General, Chief of Public Affairs, Safety, Staff Judge Advocate, Surgeon, and Internal Review and Audit Compliance. These offices provide support services of a specialized nature to the Command.

4. SUBCOMMANDS. Subcommands are comprised of Cadet Command, USATRADOC Analysis Command, and USATRADOC Test and Experimentation Command. Each commander has full responsibility to act within his functional areas or as specifically directed by the USATRADOC Commanding General.

UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND

(USATRADOC) ORGANIZATION CHART



APPENDIX C

UNITED STATES ARMY AVIATION CENTER (USAAVNC) MISSION

UNITED STATES ARMY AVIATION CENTER

(USAAVNC) MISSION

United States Army Aviation Center (USAAVNC) at Fort Rucker, Alabama, was formed during the early months of United States involvement in World War II. USAAVNC has nearly 8500 military personnel and Army civil service employees in eight directorates, five training departments, and numerous supporting activities.

As a major Army education and training institution, USAAVNC receives policy direction from United States Army Training and Doctrine Command (USATRADOC), Fort Monroe, Virginia. Career education and technical training for aviation personnel at USAAVNC is guided by the philosophy that the Army field commander must be provided with the aviation concepts, personnel, and equipment necessary for successful completion of an assigned mission.

USAAVNC primary mission is to train aviation soldiers and develop leaders to be tactically and technically competent, instilling in them a warrior spirit, assess needs of combatant commanders, and develop realistic doctrine, material requirements, and force designs. USAAVNC is also responsible for providing a vision of Army aviation concepts, personnel, and equipment.

The USAAVNC commander has identified areas that will be critical to USAAVNC to meet the challenges of the 1990's. During a time of downsizing of the force, redefining the mission, and reduction of resources, USAAVNC career education and technical training requirements for aviation personnel continue to increase. For the 1990's, USAAVNC must do the following:

A. Produce aviation soldiers and leaders who do their jobs safely.
B. Train aviation personnel ready to fight and win as individuals, crews, and teams.
C. Formulate a dynamic and realistic group of aviation plans.
D. Develop a total Army aviation force capable of conducting sustained operations throughout the employment of Army forces, world-wide.
E. Produce aviation leaders who provide purpose, direction, and motivation to the force.
F. Make Fort Rucker, Alabama, the Installation of Excellence within the Army school system.

The philosophy of the Army Aviation Center advocates six principles of learning:

A. Performance-based instruction which requires the students to learn critical job tasks by performing them in the training situation.
B. Absolute performance criteria defined in terms of the performance of job tasks which are applied to evaluate the student proficiency.
C. Functional content training in which the theory, principles, and procedures are learned within the substance of their application of job task.
D. Individualization of instruction which recognizes the variation in skill, ability, and prior experience of each individual.
E. Feedback which closes the communications loop between student and instructor, thereby improving the performance of both by the exchange.
F. Quality control which calls for continuing assessment of the performance of instructors, students, and graduates to assure that training goals are achieved and standards are maintained.

Incorporation of these learning principles in the aviation education and training program for students requires a constant orientation of adult learning concepts in the design of curricula, training strategies, methods and media, and in student evaluation. USAAVNC must determine the job tasks to be mastered, design the education and training to fit the student, and evaluate each student's achievement on the basis of performance. USAAVNC serves the Army by providing the highly qualified aviation personnel who are so vital for the Army's ground combat role and United States defense and national interests.

APPENDIX D

UNITED STATES ARMY AVIATION CENTER (USAAVNC) ORGANIZATION

UNITED STATES ARMY AVIATION CENTER (USAAVNC) ORGANIZATION

USAAVNC is organized into the following principal subdivisions:

1. COMMAND GROUP. The Command Group comprises the offices of The Commanding General/Commandant, Assistant Commandant, Chief of Staff, Garrison Commander, and Deputy Assistant Commandant.

2. PERSONAL STAFF. The Personal Staff comprises the offices of The Secretary General Staff, Command Historian, Liaison Officer, Equal Employment Opportunity Officer, Public Affairs Officer, Staff Judge Advocate, Inspector General, and Chaplain.

3. SPECIAL STAFF. The Special staff comprises the offices of The Aviation Proponent Office, Safety Office, Provost Marshal, United States Army Reserve Advisor, USAAVNC School Secretary, Internal Review and Audit Compliance, and Director of Information Management. These offices provide and/or support services of a specialized nature to the Command Group.

4. DIRECTORATE DEPARTMENT AND STAFF OFFICES. The Directorate Staff is comprised of the Directors of Training and Doctrine; Resource Management; Contracts; Personnel and Community Activities; Plans, Training, Mobilization, and Security; Logistics; Engineering and Housing; Combat Developers; Evaluation and Standards; Health and Dental Services; Aviation Proponent; and Reserve Component Support. Each director has full responsibility to act within his functional areas or as specifically directed by the Assistant Commandant and Chief of Staff.

5. TRAINING DEPARTMENTS/ACTIVITIES. USAAVNC's five training departments/activities are identified as follows:

a. Department of Enlisted Training.

b. Department of Combined Arms Tactics.

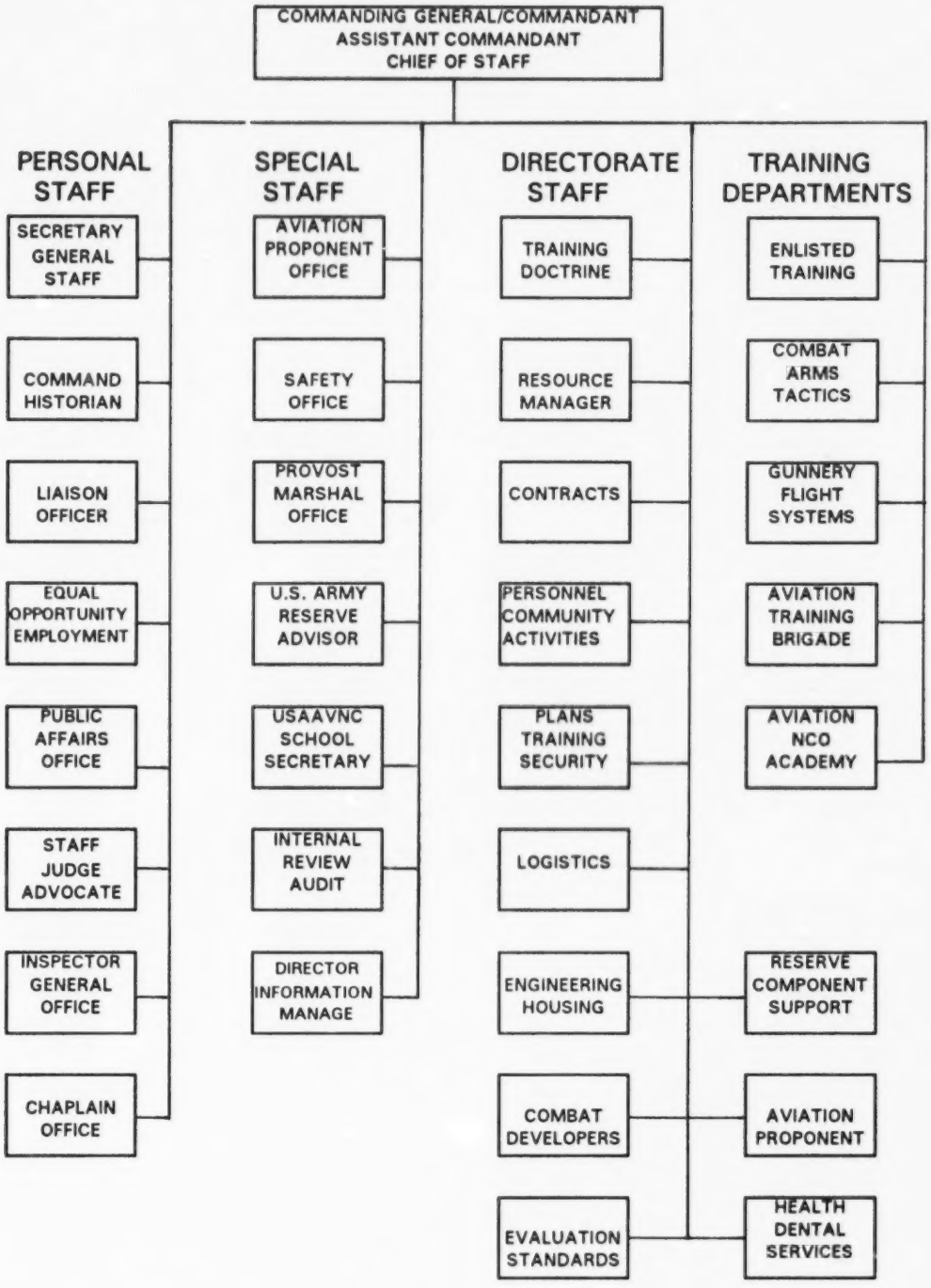
c. Department of Gunnery and Flight Systems.

d. Aviation Training Brigade.

e. United States Army Aviation Noncommissioned Officers Academy.

6. SEPARATE COMMAND. Two separate Commands are identified as The 1st Aviation Brigade and The Aviation Training Brigade, which exercise command over assigned and attached personnel.

UNITED STATES ARMY AVIATION CENTER (USAAVNC) ORGANIZATION



APPENDIX E

INTERVIEW QUESTIONS

INTERVIEW QUESTIONS

Interviews were conducted to identify workforce education and training requirements for communication and information technologies in the USAAVNC workplace with key personnel that know the USAAVNC mission, modernization plans, and human resources development program. Key personnel included designated education specialists, training developers, information management and technology specialists, and their supervisors; directors, Personnel Department and Information Management Directorate at USAAVNC; and directors, Personnel Department and Information Management Directorate at Headquarters, USATRADOC.

The following interview questions were asked:

1. Why use communication and information technologies at USAAVNC?
2. What are the applications, programs, and plans for communication and information technologies?
3. What unique worker specific critical skills or competencies should be recognized as required for the USAAVNC workforce to use communication and information technologies?
4. What should be the workforce education and training requirements for communication and information technologies at USAAVNC?

Key personnel from USATRADOC and USAAVNC staff provided information during interviews on (1) uses of communication and information technologies; (2) applications, programs, and plans for these technologies; (3) unique worker desired critical skills; and (4) workforce education and training requirements at USAAVNC.

APPENDIX F

WORKFORCE SURVEY

SURVEY OF WORKFORCE

Your participation in this survey is voluntary and anonymous. The information summarized from this survey will be used for planning purposes to improve human resources development plans.

Section I. Communication and Information Technologies in the Workplace.

1. The following list contains a series of potential applications of communication and information technologies for administrative purposes and instruction development. Please rank the ten (10) most important applications according to how you feel about the significance of using these technologies in your workplace. The most important application give a "10," the next important "9," "8," "7," "6," and so forth. If you feel very strongly about certain applications not listed, you may write them in the appropriate space and rank them. Rank (10) only.

/ / Word processing on a desktop computer
/ / Electronic filing
/ / Budgeting resources
/ / Electronic presentations/briefings
/ / Electronic mail
/ / Monitoring work progress
/ / Processing information
/ / Data manipulation
/ / _____

/ / Controlling
/ / Videoconferencing
/ / Problem solving
/ / Goal setting
/ / Forecasting
/ / Project management
/ / Desktop publishing
/ / Scheduling
/ / _____

What bothers you about the applications of communication and information technologies in the USAAVNC workplace? _____
_____USE BACK OF SHEET IF NEEDED

2. The following list contains a series of potential job critical skills required when using communication and information technologies for administrative purposes and instruction development. Please rank the ten (10) most important skills according to how you feel about them in relation to using these technologies in the workplace. The most important application give a "10," the next important "9," "8," "7," "6," and so forth. If you feel very strongly about certain skills not listed, write and rank them in the appropriate space. Rank 10 only.

/ / Organizing your own work
/ / Getting along with others
/ / Electronic presentations/briefings
/ / Knowledge/technical ability
/ / Ability to learn quickly
/ / Research in network/data bases
/ / Negotiation through consensus building
/ / Evaluating alternatives
/ / Putting ideas into practice
/ / Monitoring performance/progress/budgets
/ / Enter data into spreadsheets/data bases
/ / Retrieving information
/ / Coping with change
/ / Influencing skills
/ / _____

/ / Electronic filing
/ / Problem solving
/ / Creativity
/ / Planning
/ / Basic computer skills
/ / Keyboarding/typing
/ / Forecasting
/ / Reasoning
/ / Goal setting
/ / Processing information
/ / Diagnostic skills
/ / Communication skills
/ / Supervisory skills
/ / Setting priorities
/ / _____

3. What should be the workforce education and training requirements to close the gap between applications of communication and information technologies and workforce critical skills at USAAVNC?

_____

_____USE BACK OF SHEET IF NEEDED

4. What bothers you about the workforce education and training requirements for communication and information technologies in the USAAVNC workplace? _____

_____

_____USE BACK OF SHEET IF NEEDED

5. Have you ever used communication and information technologies?

// YES, then continue with the questionnaire.
// NO, then go directly to Section II.
// DO NOT KNOW? Then talk to individual who gave you the questionnaire.

6. Check any of the following communication and information technologies that you have used.

// Desktop Computer	// Networked Systems	// Facsimile (Fax)
// Videoconference	// Telecommunications	// Data Bases
// Desktop Publishing	// Word Processing	// other:_____

_____

_____USE BACK OF SHEET IF NEEDED

7. When did you start using communication and information technologies:

// at home? __/__ month/year? // at work? __/__ month year?

8. Was working with communication and information technologies:

// A positive experience? // A negative experience? // Do not know?

Describe your experience with communication and information technologies? _____

_____

_____

_____

_____

_____USE BACK OF SHEET IF NEEDED

9. Does your current job performance plan or efficiency report support form direct you to use communication and information technologies on the job?

// Do not know // No // Yes

If yes, how will you use these technologies?_____

_____

_____

_____USE BACK OF SHEET IF NEEDED

10. Was successful completion of any education and training requirements a condition before working with communication and information technologies?

// Do not know // No // Yes

If yes, then describe the education and training:_____
_____
_____USE BACK OF SHEET IF NEEDED

11. How would you rate the adequacy of your education and training before working communication and information technologies?

// Poor // Fair // Average // Good // Excellent

Explain:_____
_____USE BACK OF SHEET IF NEEDED

12. How would you rate the relevancy of your education and training before working communication and information technologies?

// Poor // Fair // Average // Good // Excellent

Explain:_____
_____USE BACK OF SHEET IF NEEDED

Section II. Characteristics of the USAAVNC Workforce Sample. Place "X" in the applicable space // or fill in the blank with the appropriate response.

1. Sex: // Male // Female

2. Date of birth: _____/_____ month/year

3. Ethnicity:

// Black of non-hispanic origin // American Indian/Alaskan Native
// White of hispanic origin // Asian/Pacific Islander
// Black of hispanic origin // White not of hispanic origin
// Other Explain: _____ USE BACK OF SHEET IF NEEDED

4. Workforce status: (Check One In Each Row)
// Military // Army civil service employee
// Administrative Support // Project Action // Supervisory
// Other Explain: _____ USE BACK OF SHEET IF NEEDED

5. Highest formal civilian education degree completed:
// Less than high school // High school diploma // GED
// Associate degree Major:_____
// Bachelor Major:_____
// Master Major:_____
// Doctorate Major:_____

APPENDIX G

KEY ELEMENTS OF A HUMAN RESOURCES DEVELOPMENT PLAN

KEY ELEMENTS OF A HUMAN RESOURCES DEVELOPMENT PLAN

The workforce education and training requirements for communication and information technologies can be grouped into four essential areas of consideration: (1) strategy, (2) scope, (3) standards, and (4) primary critical tasks. These areas represent the basis for the key elements of a USAAVNC human resources development plan.

Strategy

The first essential area of significance is the strategy concerning workforce education and training for communication and information technologies. The following strategy is required for the successful preparation of workers to accept, use, and integrate these technologies to accomplish the USAAVNC mission:

Establish centralized source of information and instruction curriculum which describes all communication and information technologies and education and training available to the workforce.

Involve workers with these technologies as early as possible in policy making and planning prior to their arrival at their work station and vendor training during the implementation of technologies with follow-up training on upgrades to systems, software, and procedures.

Configure the architecture of technologies to facilitate work requirements so that workers can increase productivity in nonroutine functions.

Establish mandatory education and training in communication and training technologies that are related to the position descriptions of workers. It is important to show workers that it is worthwhile to learn new technologies.

Adjust the USAAVNC human resources development goals for communication and information technologies under the context of refining current strategies, plans, programs, and budgets related to modernization.

Link knowledge and proficiency in these technologies to the annual appraisal of workers' performance. Workers are very concerned about the usefulness of the technologies that they are trying to learn.

Enroll workers in education and training for communication and information technologies only when they have access to these technologies and a specific work assignment that requires the application of newly acquired skills.

Provide equal opportunity, money, and time for workers to attend education and training for technologies.

Encourage workers to participate in training that supports the job's requirements and organization's mission rather than merely allowing workers to participate in training that they want for reasons other than job-related.

Create workplace conditions that contribute to helping the worker want to learn these technologies and see the value in learning.

Scope

The second essential area of significance is the scope of workforce education and training for communication and information technologies:

Base the desired learning outcome of the education and training on the required qualifications of the worker's position.

Analyze the worker's job to reveal the skills required by a given position with a focus on performance as opposed to knowledge. This emphasis is important because in the workplace the application of knowledge is more important than simple recall of knowledge.

Identify the worker critical skills through job analysis and state the conditions under which the worker must perform the job. The skills and conditions would also serve as the foundation for developing performance standards for annual performance evaluation and appraisal of the worker.

Provide individual assistance and feedback on what workers have learned as it relates to the worker's performance in specific areas.

Develop alternative, efficient training processes which take into account individual learning styles, abilities, and life circumstances of the worker.

Educate workers in the capabilities of these technologies so that they see the potential and value-added to their activities in the workplace.

Educate workers in the benefits of these technologies to the individual, as well as to the organization's mission.

Form user groups in workplaces to share applications of communication and information technologies and common work problems. Continuous classes and periodic updates are significant for new systems, software, and procedures.

Designate trainers of technologies who are subject matter experts in the workplace to help fellow workers when problems are encountered in using the systems, software, and procedures. When necessary, these trainers would serve as role models, mentors, and evaluators to guide and advise co-workers as they achieve mastery of necessary qualifications and credentials.

Develop and maintain a learning atmosphere in the workplace where opportunities exist for workers to acquire basic computer knowledge and skills that are necessary for them to be technology literate.

Provide training in software applications.

Standards

The third essential area of significance is the standards of workforce education and training for communication and information technologies:

Adjust the instructional design of workforce education and training to the desired competencies and acceptable skill levels for communication and information technologies.

Provide workers with equal opportunity, time, and resources to practice their newly acquired knowledge and skills when they return to their workplaces. Workers need to integrate new knowledge and skills with what they already know if they are going to keep and use the skills.

Standardize workforce education and training requirements that are fully understood and accepted by the workers as part of the agreement to occupy their position in the workplace.

Design education and training for technologies that address workers' skills, knowledge, and abilities so that the curriculum is job relevant, gives positive feedback, and encourages self-confidence and self-directed learning in the workers. Workers should be provided the opportunity to acquire practical, real-world knowledge and skills that they can use in the workplace to help them do their work or improve their performance. The need for applications and explanations of how-to information is a strong motivator for workers to learn how to use technologies.

Build training on elements familiar to the workers from past learning, experiences, and tasks that practice job-related problem-solving in workplace.

Provide education and training for technologies that are self-paced and individualized. Fast-paced, complex, or unusual learning objectives interfere with learning of the concepts or skills they are intended to teach or illustrate.

Train workers in a building block approach while learning skills in a sequential order. Help workers feel safe and capable in early training stages.

Allow workers to gain complete mastery of skills from previous training before moving on to subsequent training. Information that has little relevancy with what is already known is acquired slowly. Workers need feedback and recognition so they know how well they are doing and learning.

Eliminate or reduce timed-pressured situations to the extent possible. Provide a comfortable learning atmosphere and take several breaks to keep the workers attentive to the instruction.

Synchronize education and training for technologies to be timely with the arrival of systems, software, and procedures in the workplace.

Primary Critical Tasks

The last essential area of significance is the primary critical tasks which require education and training in the communication and information technologies that will be used for administrative purposes and the development of aviation instruction:

Typing/keyboarding

Using software--word processing, spreadsheets, files, graphics

Processing information--retrieve, store, manipulate, control

Preparing plans, spreadsheets, presentations, and briefings

Diagnostic skills to solve problems in systems, software, and procedures

Monitoring progress, suspense actions, and milestones

Networking with distributed systems

Research techniques using technologies in the development of instruction

Understand technical documents of systems, software, and procedures.

BIOGRAPHIC SKETCH

Michael (Mike) Wayne Cupples was born on 13 October, 1948 in Jackson, Tennessee. He is married to the former Barbara Sue Smith of Brighton, Tennessee. They have four children: Michael Wayne II, Mary Elizabeth, Matthew Smith, and Melissa Catherine.

Mike Cupples has completed higher levels of both civilian and military education. His civilian education includes a Bachelor of Science in Electrical Engineering from the University of Tennessee, Knoxville, Tennessee and a Masters in Management from Webster University, St Louis, Missouri. He has also completed military education of graduate level: Command and General Staff College, Logistic Executive Development, and Rotary Wing Helicopter Qualification. He has flown 1976 hours in helicopters.

Mike Cupples has published a paper titled "Emergence of Vocational, Technical, and Occupational Education (E-VTO)" in Resources in Education, 50 pages, dated 1989. A microfiche copy of this paper may be obtained from ERIC Clearinghouse on Adult, Career, and Vocational Education, 1900 Kenny Road, Columbus, Ohio, 43210-1090. The phone number for ERIC Clearinghouse is 1-800-848-4815.

Mike Cupples has professional work experience that encompasses twenty-one years of military service as an Army officer and aviator. His highest rank attained was Lieutenant Colonel. He belongs to three professional military organizations: Association of United States Army, Army Aviation Association of America, and Retired Officers Association.

Mike Cupples has over twelve years of successful management experience of technical services in research and analysis; systems development, experimentation, and evaluation; instruction and curriculum development for advanced technologies; and technical briefings to senior executives. These experiences provided him strong computer skills and research, analysis, and evaluation techniques; grasp of technical and analytical matters; and excellent task management, budget estimate, and resources allocation.

Most recent efforts by Mike Cupples were as a Program Manager with Federal Aviation Administration (FAA) Technical Center, Atlantic City International Airport, New Jersey from April, 1991 to 1 September, 1992. In this position, he researched, analyzed, and wrote decision papers to real world problems and issues concerning flight safety and airworthiness standards for airlines and general aviation. He also provided flight safety research information on studies from external agencies for FAA research and certification efforts.

From January, 1987 to March, 1991, Mike Cupples was the Director of Flight Education/Training developmental activities at the United States Army Aviation Center, Fort Rucker, Alabama. He provided staff supervision of an organization of sixty-eight education specialists and training developers performing aviation training operation research/systems analysis; curriculum and instruction development; and world class flight simulator development, acquisition, and fielding. He developed decision papers and briefings to senior decision makers on educational soundness, training scope, and training feasibility of proposals for aircraft, flight systems, and flight simulators supporting institutional and world-wide sustainment training.

From November, 1983 to December, 1986, Mike Cupples was the Chief of Test Operations for a developmental simulation testbed working airspace, aircraft, and flight systems issues at Albuquerque, New Mexico. He provided staff supervision of a test and evaluation cell of twelve engineers/technicians performing government requirements development, fielding, and acceptance evaluation of a $300 million simulation architecture. He analyzed industry-provided documentation and simulator design specifications that enabled optimal prototypes and final deliverables for systems and software acceptance evaluation associated with advanced technology simulation.

From January, 1980 to October, 1983, Mike Cupples was a Test Project Manager for flight communications, navigation, and electronic systems at the United States Army Operational Evaluation Agency at Fort Rucker, Alabama. He provided an assessment of sophisticated aircraft and flight systems using experimentation, test, and evaluation techniques and relying heavily upon helicopter flight experience to senior decision makers to develop and buy. He wrote, coordinated, and implemented test plans/experiments/reports; scored test/experiment progress; solved complex test/experiment procedure problems; and did time, manpower, and budget estimates in the experiment, test, and evaluation process.